State of Wisconsin I-90/94 Earmark Evaluation

Local Evaluation Final Report

Prepared For:

Wisconsin Department of Transportation

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1.0 EXECUTIVE SUMMARY

This report presents the results of the Interstate 90/94 ITS Earmark Evaluation. The State of Wisconsin Department of Transportation (WisDOT) conducted this evaluation to determine how well the projects funded under the I-90/94 Earmark performed at meeting the goals set by the Federal Highway Administration (FHWA) including improving the mobility, productivity and safety of travelers within the I-90/94 corridor. The four projects that were evaluated are listed as follows:

- Purchase of laptop computers for District 6 County Highway Department forces
- Funding for ITS Technology for low and high-speed weigh-in-motion
- Changeable Message Sign purchases
- Permanent Highway Advisory Radio at the Hudson "Port-of-Entry"

Two additional activities were also conducted as part of the evaluation:

- An evaluation of the institutional issues associated with achieving cooperation among public sector agencies including documentation of how problems were overcome.
- Development of a brief lessons learned report on the technical and institutional issues encountered in integrating ITS components.

The following sections describe the results of the evaluations of each of the four projects and of the additional activities.

1.1 Laptop Computer Purchase

The I-90/94 ITS Earmark provided funding for WisDOT District 6 to purchase laptop computers that were distributed to County Highway Department Patrol Superintendents. The purpose of the laptop computers was to provide county personnel with a means to access weather forecast information remotely, from their vehicle. This would allow the superintendents a better means to predict, provide staff, and respond to weather event and hazardous travel conditions. The computers were also intended to perform other functions for the county superintendents, including remote operation of portable changeable message signs, maintaining remote contact with WisDOT District 6 using e-mail, and input to and retrieval of information from the statewide storm report database.

1.1.1 WisDOT District 6 County Highway Superintendent Survey Results

Surveys were returned by six of the eight county patrol superintendents in WisDOT District 6: Eau Claire, St. Croix, Chippewa, Pierce, Dunn, and Clark Counties. The results of the County Highway surveys with respect to the stated objectives for the laptop computers can be summarized as follows:

<u>**Objective**</u>
<u>**Results**</u>
<u>Reduce the operation costs to operators incurred from inefficient transportation facilities</u>
• The strongest response in agreement of reduced operating costs was in the area of lower salt and deicer use

• There was less consensus on reduced overtime hours • Reduction in vehicle fleet maintenance had the least consensus regarding improved operations
Reduce the costs and improve the quality of data collection for transportation system planning, use operations, maintenance and installations
• Most of the respondents reported using the laptop computer for field data collection, while one respondent reported using the laptop computer for producing storm reports
Improve the ability to identify, respond and/or mitigate the effects of incidents
• All of the respondents felt that using the laptop computers resulted in either a moderate improvement or slight improvement in response to winter weather events

Additional findings and feedback that summarize the results of the surveys of District 6 County Highway Superintendents for the use of the laptop computers are:

- In general, the laptop computers served the County Highway Superintendents' needs, and made weather information related to their duties responding to storms more accessible to them, in a mobile environment.
- There is insufficient information to determine conclusively that using the laptop computers reduced operating costs. However, the surveyed opinions of the superintendents, at a minimum, indicated a consensus that the units helped moderately decrease the use of salt and deicers.
- The superintendents reported using the laptop computers for additional functions that helped their overall operation, including communicating with other agencies by e-mail, data collection, preparing storm reports, and operating the portable changeable message signs

1.2   Portable Weigh-In-Motion (PWIM) System

The deployment of the PWIM system was delayed due to problems with the system software. It is therefore not possible to evaluate the system at this time. The Wisconsin State Patrol plans to attempt to deploy the system in Spring 2004.

1.3   Portable Changeable Message Signs (PCMS) Purchase

The I-90/94 ITS Earmark provided funding for WisDOT to purchase Portable Changeable Message Signs (PCMS) to be used to provide traveler information on traffic incidents, special events and advanced warning for construction projects. Twenty solar powered LED portable CMS, ten (10) solar powered Hybrid portable CMS and nine (9) portable remote control base stations were purchased and were distributed to WisDOT Districts 1, 5, and 6. The objectives of the Portable Changeable Message Signs included:

- Increase the accessibility of information to travelers in the I-90/94 corridor
- Enhance the productivity of WisDOT and State Patrol staff while handling traffic incidents, construction, and special events

- Enhance safety by reducing the response time to incidents, and providing information to better alert motorists of work zones and other conditions requiring caution

The State Patrol officials in these Districts were responsible for using and directing the use of the Portable Changeable Message Signs for responding to incidents and emergencies. WisDOT operating staff used the signs more for managing planned construction and maintenance activities along the I-90/94 corridor. Surveys were distributed to both the Wisconsin State Patrol officials and WisDOT operations officials responsible for the use of the Portable Changeable Message Signs, to determine if the objectives of the signs were achieved. An analysis of the data gathered from a previous survey of Wisconsin drivers was also conducted to determine the user's perceptions of the effectiveness of PCMS.

1.3.1   Analysis of the Wisconsin Driver Survey Results Summary

This test involved the analysis of data from a previous user survey conducted by the University of Wisconsin-Madison. The Wisconsin Driver Survey was mailed to a random sample of 500 drivers in 22 Wisconsin counties. The survey contained questions designed to determine user awareness and perceptions of the use of variable message signs (VMS) in providing traveler information. A description of VMS provided in the survey included a description and pictures of both portable and permanent VMS and while some survey questions refer specifically to portable VMS, some refer to VMS in general. Responses to questions about VMS were collected from the survey response database for drivers residing at zip codes located within the three districts where the portable CMS purchased were deployed. Since there are no permanent variable message signs located in the three districts where the portable CMS were distributed, it was assumed that responses to the questions about VMS refer primarily to the user's experience with portable CMS. A statistical analysis of the data collected from the response database was then performed to determine user perception of the use of the portable CMS to provide information about incidents, maintenance activities, special events and warning of planned construction activities. The analysis was based on seventy-four (74) responses from zip codes located within WisDOT Districts 1,5,6.

The results of the analysis of the Wisconsin Driver Survey data with respect to the stated objectives of the Portable Changeable Message Sign purchase can be summarized as follows:

Objective   **Results**
Improve the accessibility and availability of travel information
Half of the users responded that there was some type of variable message sign on the routes that they traveled most frequently.

Objective
Results
Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.
- The majority of users felt that variable message signs would be effective at reducing driving time (78%).   - The majority of users indicated that they felt that the information provided on portable changeable message signs was reliable (74%).   - Users responded positively to all of the types of information provided on variable message signs. In particular, a large percentage of respondents felt that information about current roadwork (94%), road hazards (93%), and alternative routes (90%) was very useful.
Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information
Users were split in terms of their use of the information on variable message signs for travel planning. 42% of users responded that on average they had adjusted their travel route based on information provided on VMS one or two times in a month during the winter months while 32% responded that they never adjusted their routes based on this information.
Reduce the number of motor vehicle collisions, associated injuries and fatalities
The majority of users (74%) felt that variable message signs would be effective at reducing the number of collisions.
Reduce time delay and costs associated with congestion
The majority of users (62%) responded that variable message signs would be effective at reducing the stress caused by driving

1.3.2 WisDOT Staff PCMS Survey Results Summary

There were ten (10) survey responses from Districts 1, 4, and 6 in the I-90/94 corridor. The results of the WisDOT Staff surveys with respect to the stated objectives can be summarized as follows:

Objective
Results
Reduce the operation costs to operators incurred from inefficient transportation facilities
While over 50 percent of WisDOT staff felt that use of the PCMS provided moderate reduction in operating costs, this item showed the lowest degree of consensus on how the PCMS improved operations. Consensus was stronger for the PCMS improving other aspects of operation.

Objective
Results
Reduce the number of motor vehicle collisions, associated injuries and fatalities
• There was a strong consensus among the WisDOT staff respondents that the use of the PCMS helped in the response to crashes, improved freeway safety, and improved worker safety in maintenance areas. However, the respondents showed lower consensus on the effectiveness of PCMS on incident clearance time and the general response time for incidents.
Optimize the operational efficiency of goods and people movement on existing facilities
• WisDOT staff respondents indicated a moderate to strong consensus that use of the PCMS improved operations in the following areas: 1) Motorist travel time (moderate improvement) 2) Information to motorists (high improvement) 3) Overall effectiveness (very effective) 4) Helpfulness for job (very helpful) 5) Special Events (very effective) 6) Weather events (very effective) 7) Planned maintenance (very effective)

Additional findings and feedback that summarize the results of the surveys of WisDOT Operations staff for the use of the Portable Changeable Message Signs are:

- WisDOT staff expressed reservations about the reliability of the communication link to the Portable Changeable Message Signs, which was a similar concern for the Emergency Response staff that responded to a separate survey.
- Overall, the WisDOT staff was in agreement with emergency response staff that the Portable Changeable Message signs were a useful and beneficial tool that enhanced the performance of their jobs.
- The WisDOT staff was also in agreement with the emergency response staff regarding the usefulness of additional Portable Changeable Message signs. Specifically, respondents stated that more than one unit is required to properly shut down I-94 for a complete closure and detour, and that for closure in a single direction, having a Portable Changeable Message Sign for managing traffic in each direction would be a great benefit.

WisDOT Staff PCMS Institutional Issues

The coordination and institutional issues for WisDOT staff operation of the Portable Changeable Message signs were minimal. However, the surveys identified the following areas of concern:

- The availability of PCMS units for planned maintenance activities (for example, bridge repairs), versus the need to always have the units available for emergencies.
- The appropriate officials in the field need to call the PCMS operators when an incident is cleared, notifying to clear the message for the incident.

- The messages for incidents have to be timed to correspond to the actual arrival of the State Patrol and wrecker (tow truck) during response.
- One respondent mentioned the issue of distinguishing a Contractor's PCMS units and their use, from WisDOT PCMS units. Perhaps this issue could be addressed with a standard memorandum of understanding (MOU) among WisDOT traffic management staff, Wisconsin State Patrol staff, and Contractors for major construction projects involving detours and lane reductions

1.3.3 Wisconsin State Patrol PCMS Survey Results Summary

Surveys were distributed to a State Patrol contact person for each of the WisDOT Districts 1, 5, and 6. A total of ten (10) state patrol officials responded to the surveys. The results of the Wisconsin State Patrol surveys with respect to the stated objectives can be summarized as follows:

<u>**Objective**</u>   <u>**Results**</u>
<u>Reduce the number of motor vehicle collisions, associated injuries and fatalities</u>
• The majority of survey respondents felt that use of the PCMS signs improved freeway safety
<u>Improve the average response time of emergency vehicles</u>
• The majority of survey respondents felt that use of the PCMS signs improved incident response time

Objective	
Results	
Improve the ability to identify, respond and/or mitigate the effects of incidents	
	• The majority of survey respondents felt that use of the PCMS signs improved incident response and clearance times, and that the signs helped improve conditions on I-90/94
	• When asked if the Portable Changeable Message Signs were effective in enhancing the efficiency and timeliness of staff responding to incidents on I-90/94, the results were mixed. There were 60% of the respondents that said the PCMS resulted in no change in their efficiency and timeliness in responding to and clearing incidents.

Additional findings and feedback that summarize the results of the surveys of Wisconsin State Patrol staff for the use of the Portable Changeable Message Signs are:

- The predominant opinion of the Emergency Response users of the PCMS was that they are a useful tool to help with their job of managing incidents
- The PCMS would be more useful to State Patrol staff if they had a more reliable communication link, and if the software had a uniform interface that was more user-friendly
- Additional PCMS (with the referenced improvements) at more locations would be helpful for better response to incidents along I-90/94.

Wisconsin State Patrol PCMS Institutional Issues

The coordination and institutional issues for Wisconsin State Patrol operation of the Portable Changeable Message signs were minimal. However, the surveys identified the following areas of concern:

- One respondent said that response time is a problem when contractors use the signs.   This was also an issue with WisDOT operating staff, and could perhaps be addressed with revising standard operating procedures, or developing a memorandum of understanding.
- Respondents stated that staff to operate the signs was difficult to reach on weekends, or similarly, that technical support for the signs was difficult to obtain. These issues might be addressed by setting up a weekend, on-call duty roster for each District.
- Another respondent mentioned that setup of the signs before the start of major projects (assumed for the purpose of providing local motorists of advance warning of traffic restrictions) could be better coordinated. Perhaps this item could be addressed by establishing a PCMS setup procedure as a checklist item at all major roadway project pre-construction meetings.

1.4   Permanent Highway Advisory Radio (HAR) System for the Hudson "Port of Entry"

This project involves the purchase of one permanent highway advisory radio (HAR), along with two alert signs and associated yellow flashers. The HAR was installed along Interstate 94 at the "port-of-entry" in Hudson, Wisconsin. The alert signs with yellow flashers were installed to serve traffic in both directions. One sign was installed for westbound traffic near mile point 5.5 on I-94 in Hudson, WI. The second sign was installed for eastbound traffic near mile point 253 on I-94 in Minnesota.

The Wisconsin State Patrol has the primary responsibility to activate and add messages to the HAR, although information can be provided to the State Patrol by other divisions within the Wisconsin Department of Transportation (WisDOT), other law enforcement agencies, and other sources. The signs will generally be activated to warn motorists of dangerous conditions, traffic delays, detours, and maintenance or construction activities. The objectives of installing the permanent HAR included:

- Improve the accessibility and availability of travel information to travelers in the corridor
- Reduce time delay by warning drivers of congestion and offering alternate routes
- Improve the safety of motorists, construction crews, law enforcement, and emergency responders by warning drivers of dangerous conditions

1.4.1   Wisconsin State Patrol HAR Survey Results Summary

Surveys were distributed to the Police Communications Operators (PCOs) at the Wisconsin State Patrol office in Eau Claire. These operators are responsible for activating and uploading messages to the HAR system. Eight surveys were returned, although one operator had not yet used the system and therefore could not answer the questions.

The results of the State Patrol surveys with respect to some of the stated objectives for the highway advisory radio system can be summarized as follows:

Objective
Results
Improve the accessibility and availability of travel information to tourist, commercial vehicle operators, and others users of all transportation facilities.
The system provides travel information for major incidents and construction activities to travelers in St. Croix County, WI and far eastern Minnesota along the I-94 corridor.
Reduce the number of motor vehicle collisions, associated injuries, and fatalities.
The State Patrol has perceived a moderate reduction in the number of secondary accidents when the HAR system has been used to warn drivers of incidents, construction, and dangerous conditions.
Reduce time delay and costs associated with congestion.

• The agency has perceived only a slight or no improvement in travel delay by using the system. The user survey should be a better indication of any potential travel time and delay improvements.

1.4.2 Web-based User Survey

A web-based user survey (found at http://www.hudson530.com) was created to get feedback from motorists who may have listened to at least one HAR broadcast message. The survey featured a series of questions designed to get feedback about the types of information motorists heard on the HAR broadcast, what decisions they made based on the information, and their preferences for the types of information they would like to get, and their satisfaction with the HAR system. Most of the questions were either multiple-choice or check-box questions, but there was also a free response comments section at the end of the survey.

Objective
Results
Improve the accessibility and availability of travel information
• The majority of those who responded (70%) said they listened to the HAR messages every time they see the alert sign flashing.   • Almost all respondents felt the HAR messages were helpful. 52% said they were somewhat helpful and 35% said they were very helpful.   • When asked to choose whether they preferred to receive various types of information via Variable Message Signs or HAR, the majority of those with a preference preferred HAR for information about weather conditions (47%), road/pavement conditions (38%) and travel times (42%).   • There are problems with the clarity of the messages due to static. 64% of the respondents said that the messages were not clear and easy to understand and 78% of these respondents said that this was due to too much static.
Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.
• While respondents felt the HAR information was useful, they were split on whether it affected whether they changed their travel route. 37% said it caused them to change their route and 40% said they it didn't affect their route choice.   • If respondents took an alternative route based on the HAR messages, the majority felt it saved them time. 46% felt they saved a lot of time and 35% said that it saved them a minute or two.
Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.
• The majority of respondents (54%) felt that the information provided on the HAR was timely enough to make decisions well in advance of the affected area. Another 16% responded that the information allowed them to make decisions just before they were affected by conditions.
Reduce time delay and costs associated with congestion.
• The majority of respondents who took an alternate route by choice based on information provided by the HAR felt that it saved them travel time.

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2.0 PROJECT DESCRIPTION

This report presents the results of the Interstate 90/94 ITS Earmark Evaluation. The State of Wisconsin Department of Transportation (WisDOT) conducted this evaluation to determine how well the projects funded under the Earmark perform at meeting the goals set by the Federal Highway Administration (FHWA) including improving the mobility, productivity and safety of travelers within the I-90/94 corridor. The four projects to be evaluated are listed as follows:

- Purchase of laptop computers for District 6 County Highway Department forces
- Funding for ITS Technology for low and high-speed weigh-in-motion
- Changeable Message Sign purchases
- Permanent Highway Advisory Radio at the Hudson "Port-of-Entry"

Two additional activities were also conducted as part of the evaluation:

- An evaluation of the institutional issues associated with achieving cooperation among public sector agencies including documentation of how problems were overcome.
- Development of a brief lessons learned report on the technical and institutional issues encountered in integrating ITS components.

2.1 Description of the I-90/94 Corridor

The I-90/94 Corridor traverses Wisconsin linking the state's major cities and providing access for Wisconsin travelers to Minnesota and Illinois. The geographic area covered by the I-90/94 corridor is depicted on the map below.

2.2 Corridor Goals and Objectives

The I-90/94 Strategic Deployment Plan was completed in late 1996 utilizing funding from the Earmark program. As part of this plan the following goals and objectives for the deployment of ITS in the I-90/94 corridor were developed by WisDOT and the FWHA:

Goal 1: Enhance Mobility and Accessibility

Objective 1.1: Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.

Objective 1.2: Reduce the variability and number of actions necessary to use public transportation facilities.

Goal 2: Enhance Productivity

Objective 2.1: Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.

Objective 2.2: Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.

Objective 2.3: Reduce the operation costs to operators incurred from inefficient transportation facilities.

Objective 2.4: Reduce the costs and improve the quality of data collection for transportation system planning, use operations, maintenance and installations.

Goal 3: Improve Safety

Objective 3.1**:** Reduce the number of motor vehicle collisions, associated injuries and fatalities.

Objective 3.2: Improve the average response time of emergency vehicles.

Objective 3.3: Improve the ability to identify, respond and/or mitigate the effects of incidents.

Goal 4: Increase Efficiency

Objective 4.1: Reduce time delay and costs associated with congestion

Objective 4.2: Optimize operational efficiency of goods and people movement on existing facilities.

Goal 5: Develop an Intercity Transportation System that Most Effectively Supports the Optimal Deployment of Appropriate Technologies

Objective 5.1: Establish intercity corridors that advance the National ITS Program and advance the deployment and integration of technology.

Objective 5.2: Establish an ITS architecture that is open and interoperable to meet future architecture needs and is consistent with the developing national standards.

The general Measures of Effectiveness for each of these goals and objectives are show in Table 2.2-1.

Table 2.2-1: I-90/94 ITS Earmark Goals, Objectives and Measures of Effectiveness

Goals	Objectives	Measures Of Effectiveness "Few Good Measures"
1. Enhance Mobility and Accessibility	1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	− Reduction in Travel Time − Reduction in Delay − Reduction in Travel Time Variability − Improvement in Customer Satisfaction
	1.2 Reduce the variability and number of actions necessary to use public transportation facilities.	− Reduction in Travel Time − Reduction in Delay − Reduction in Travel Time Variability − Improvement in Customer Satisfaction
2. Enhance Productivity	2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	− Cost Savings due to Reduced Delay
	2.2 Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.	− Cost Savings due to Reduced Delay
	2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	− Reduction in Operating Costs
	2.4 Reduce the costs and improve the quality of data collection for transportation system planning, use operations, maintenance and installations.	− Reduction in Data Collection Costs
3. Improve Safety	3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	− Reduction in Rate of Crashes − Reduction in Rate of Crashes Resulting in Injuries − Reduction in Rate of Crashes Resulting in Injuries
	3.2 Improve the average response time of emergency vehicles.	− Average Response Time
	3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents	− Average Detection Time − Average Response Time − Average Clearance Time
4. Increase Efficiency	4.1 Reduce time delay and costs associated with congestion	− Reduction in Delay due to Congestion
	4.2 Optimize operational efficiency of goods and people movement on existing facilities.	− Increase in Throughput or Effective Capacity
5. Develop an Intercity Transportation System that most effectively Supports the Optimal Deployment of Appropriate Technologies	5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration of technology.	− Coverage Area − Integration with Existing & Planned ITS Components
	5.2 Establish an ITS architecture that is open and interoperable to meet future architecture needs and is consistent with the developing national standards.	− Consistency with Regional & National ITS Architecture − Consistency with National Standards

2.3 Projects to be Evaluated

A detailed evaluation plan is provided in Section 2.0 of this report for each of the four projects described as follows:

- *Purchase of laptop computers for District 6 County Highway Department Forces*: Funding was provided for the purchase of laptop computers to be distributed by WisDOT District 6 to County Highway Department Patrol Supervisors to improve access to weather information used to make maintenance decisions.

- *Portable Weigh-in-Motion Systems:* Funding was provided for the purchase of portable weigh-in-motion system equipment to be used for mobile motor carrier enforcement by the Wisconsin State Patrol.

- *Changeable Message Sign purchases:* Funding was provided for the purchase of portable Changeable Message Signs for WisDOT Districts 1, 5, and 6 to be used to provide traveler information on traffic incidents, special events and advanced warning for construction projects.

- *Permanent Highway Advisory Radio for the Hudson "Port-of-Entry":* Funding was provided for WisDOT District 6 to purchase and deploy one permanent highway advisory radio (HAR) to be located along I-94 at the "port-of-entry" in Hudson, Wisconsin.

Table 2.3-1 shows the relationship of each of these projects to the I-90/94 corridor goals and objectives.

Table 2.3-1: Relationship of the I-90/94 Goals and Objectives to the Funded Projects

GOALS	OBJECTIVES	I-90/94 Earmark Solutions (Projects Implemented)			
		Permanent Highway Advisory Radio at the Hudson State Line	Portable CMS for Districts	Laptop Computers for District 6 County Forces	Portable WIM
1. Enhance Mobility and Accessibility	1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	X	X	X	
	1.2 Reduce the variability and number of actions necessary to use public transportation facilities.				
2. Enhance Productivity	2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	X	X	X	X
	2.2 Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.	X	X		
	2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	X	X	X	X
	2.4 Reduce the costs and improve the quality of data collection for transportation system planning, use operations, maintenance and installations.			X	
3. Improve Safety	3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	X	X	X	X
	3.2 Improve the average response time of emergency vehicles.		X		
	3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents	X	X	X	
4. Increase Efficiency	4.1 Reduce time delay and costs associated with congestion	X	X		
	4.2 Optimize operational efficiency of goods and people movement on existing facilities.	X	X	X	X
5. Develop an Intercity Transportation System that most effectively Supports the Optimal Deployment of Appropriate Technologies	5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration of technology.	X	X		X
	5.2 Establish an ITS architecture that is open and interoperable to meet future architecture needs and is consistent with the developing national standards.				

3.0 EVALUATION PLANS

3.1 Laptop Computer Purchase

3.1.1 Project Description

The I-90/94 ITS Earmark provided funding for WisDOT District 6 to purchase laptop computers that were distributed to County Highway Department Patrol Superintendents for the purpose of maintaining Interstate 94 in their respective counties. The goal of this project was to provide county personnel with a means to access weather forecasting information remotely allowing them to better predict, staff and respond to weather events and hazardous travel conditions. In addition, the laptop computers provide county personnel with the ability to manage changeable message signs on I-94 for incident management purposes and to collect and store information about maintenance activities.

3.1.2 Goals, Objectives, Measures of Effectiveness and Hypotheses

The goals and objectives that are applicable to this project as well as the hypotheses and measures of effectiveness to be used in evaluating whether the purchase of the laptops effectively achieved these goals are outlined in Table 3.1-1.

Table 3.1-1: Purchase of Laptop Computers - Goals, Objectives, Hypotheses, and MOE

Goal	Objective	Hypothesis	Measures Of Effectiveness
1. Enhance Mobility and Accessibility	1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	The laptops will provide access to CMS allowing County Forces to provide useful information to travelers about traffic incidents.	– Agency User Perception of the Usefulness of the Laptops for Accessing CMS
2. Enhance Productivity	2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	Access to weather information will allow County Forces to better maintain the Interstate during weather events thereby reducing delay and increasing reliability.	– Agency User Perception of delay reduction
	2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	Use of the laptops will allow for more efficient use of County resources thereby reducing operating costs.	– Reduction in Operating Costs for Counties for Road Maintenance during weather events
	2.4 Reduce the costs and improve the quality of data collection for transportation system planning, use operations, maintenance and installations.	Using the laptop computers will reduce the time needed to collect store, and analyze highway winter maintenance data.	– Agency User Perception of the Reduction in Data Collection Costs
3. Improve Safety	3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	Access to weather information will allow County Forces to better maintain the Interstate during weather events thereby reducing the number of collisions caused by poor road surface conditions.	– Agency Perception of Reduction in Rate of Crashes, crashes resulting in injuries and crashes resulting in fatalities during weather events.
	3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents	Access to CMS for will allow County Forces to provide information to travelers thereby reducing the impact of incidents.	– Agency Perception of Incident Management Benefits of Laptops
4. Increase Efficiency	4.2 Optimize operational efficiency of goods and people movement on existing facilities.	Use of the laptops will allow County Forces to more efficiently use their resources.	– Agency Perception of Reduced Response time to weather events

3.1.3 Evaluation Approach

The approach to be taken in evaluating each of the objectives for this project is described as follows in Table 3.1-2.

Table 3.1-2: Laptop Evaluation Approach

Objective	Measures Of Effectiveness	Evaluation Approach
1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	– Agency User Perception of the Usefulness of the Laptops for Accessing CMS	– A survey questionnaire will be distributed to the County Highway Department Patrol Superintendents
2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	– Agency User Perception of delay reduction	– A survey questionnaire will be distributed to the County Highway Department Patrol Superintendents
2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	– Reduction in Operating Costs for Counties for Road Maintenance during weather events	– The average operating cost per winter storm event will be determined and compared for years before and after the use of laptops by the County Highway Department.
2.4 Reduce the costs and improve the quality of data collection for transportation system planning, use operations, maintenance and installations.	– Agency User Perception of the Reduction in Data Collection Costs	– A survey questionnaire will be distributed to the County Highway Department Patrol Superintendents
3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	– Reduction in Rate of Crashes, crashes resulting in injuries and crashes resulting in fatalities during weather events.	– A survey questionnaire will be distributed to the County Highway Department Patrol Superintendents
3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents	– Agency Perception of Incident Management Benefits of Laptops	– A survey questionnaire will be distributed to the County Highway Department Patrol Superintendents
4.2 Optimize operational efficiency of goods and people movement on existing facilities.	– Agency Perception of Reduced Response time to weather events	– A survey questionnaire will be distributed to the County Highway Department Patrol Superintendents

3.1.4 Evaluation Test Plans

There are three main tasks to be completed in the evaluation of the Laptop Computer Purchases:

- Survey of the Perceptions of the Agency Users
- Analysis of Relevant Accident Data
- Analysis of County Maintenance Data

The plans for completing each of these tests are described in the following sections.

3.1.4.1 Agency User Survey

- **Goal Tested:** This test will be used to evaluate goals 1, 2, 3, and 4.

- **Data Collection:** A survey questionnaire will be developed and distributed to County Highway Department Patrol Supervisors and other staff impacted by the use of the laptops. This survey will be used to determine their perceptions of the of the effectiveness of the laptop computers in achieving the project goals including:

  - How effective has the use of the laptops been in reducing the time required to respond to winter storm events?
  - How effective are the laptops in helping to reduce delay and improve travel conditions during winter storm events.
  - Do the laptops improve the process required for collection and storage of maintenance related data.
  - How effective are the laptops for accessing CMS for incident management purposes.

- **Data Analysis:** A statistical analysis of the survey responses will be performed. The results of this analysis and of the perceptions of the users will then be summarized.

- **Schedule:** Distribution of the survey is planned for January/February 2003.

3.1.4.2 Analysis of Maintenance Data

- **Goal Tested:** This test will be used to evaluate Goal 2, which addresses productivity increases.

- **Data Collection:** Data will be collected from the Summary of Winter Maintenance Report maintained by the WisDOT Bureau of Highway Operations and from the County Highway Department Weekly Maintenance Reports. Data from the winter seasons prior to and after the deployment of the laptops will be collected.

- **Data Analysis:** The average operating costs before and after the deployment of the laptops for the counties deploying laptop computers will be determined including:

  - Total and average amount of salt used
  - Total and average amount of equipment used
  - Total and average number of employees performing maintenance

To account for variations in the intensity of winter seasons each of these costs will be given in relation to amount of snow fall per season (i.e. salt/inches of snowfall)

- **Schedule:** This activity will be ongoing. However, collection of data for the current year will not begin until December 2002.

3.1.5   Additional Evaluation Activities

Institutional Issues Evaluation

This activity will address issues involving the cooperation between the County Highway Department Patrol Superintendents and their maintenance staff and between the County Highway Department and WisDOT during the purchase and use of the laptops including:

- Problems with the procurement and distribution of the laptops
- Additional uses for and benefits associated with the laptop computers
- Training issues

Information for this activity will be gathered using the Agency User Survey and through interviews with WisDOT District 6 and Central Office personnel.

Lessons Learned Report

This activity will address the technical and institutional issues encountered during the purchase and use of the laptop computers including:

- Problems associated with the use of the laptops to access weather information
- Problems associated with the use of the laptops to access CMS
- Problems associated with the use of the laptops to collect and store maintenance data

Information for this activity will be gathered using the Agency User Survey and through interviews with WisDOT District 6 and Central Office personnel.

3.2   Portable Weigh – in – Motion System

3.2.1   Project Description

This project involves the purchase of three High Speed and one Low Speed Portable Weigh-in-Motion Systems to be used for mobile enforcement of motor carriers by the Wisconsin State Patrol. Currently there are 12 permanent WIM sites and 167 portable static scales in use in Wisconsin. The goal of this project is to increase enforcement by increasing the efficiency and flexibility of weigh stations. Portable WIM stations offer advantages over permanent WIM in that they can be placed in remote locations allowing the State Patrol to screen commercial vehicles that don't normally pass through permanent sites. They are also more efficient than portable static scales since they increase the number of vehicles that can be weighed and reduce the time spent in queues by compliant vehicles.

The scales will be used for screening purposes only. Motor carriers will pull off the freeway and drive through the WIM scales at a moderate speed (approximately 30 mph) for both the high and

low motion scales. If a problem with their weight is detected, they will be pulled aside for further inspection and brought to a static scale for an official weight measurement.

3.2.2 Goals, Objectives, Measures of Effectiveness and Hypotheses

The goals and objectives that are applicable to this project as well as the hypotheses and measures of effectiveness to be used in evaluating whether the Weigh-in-Motion System purchase effectively achieved these goals are outlined in Table 3.2-1.

Table 3.2-1: Portable WIM System - Goals, Objectives, Hypotheses, and MOE

Goal	Objective	Hypothesis	MOE
2. Enhance Productivity	2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	Portable WIM will reduce the delay experienced by commercial vehicles at portable screening stations.	Overall Delay Reduction Queue Delay Reduction
		Portable WIM will provide a reliable method for screening for overweight commercial vehicles.	Acceptable scale accuracy
	2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	WIM will result in reduced operation costs for trucking companies.	Reduction in operating costs associated with delay
		WIM will result in a reduction in operating costs for the WisDOT State Patrol.	Reduction in Personnel Costs Reduction in Maintenance Costs
3. Improve Safety	3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	Increased enforcement for overweight violations will result in fewer unsafe commercial vehicles on the Interstate thereby reducing the number of collisions and associated injuries and fatalities.	Increased Citations for Overweight Violations Increase in Enforcement of Safety Violations due to Portable WIM
4. Increase Efficiency	4.2 Optimize operational efficiency of goods and people movement on existing facilities.	The use of Portable WIM will increase the efficiency with which vehicles are screened for overweight violations.	Increased Weigh Station Throughput
5. Develop an Intercity Transportation System that most effectively Supports the Optimal Deployment of Appropriate Technologies	5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration of technology.	The use of portable WIM will increase the rate of overweight vehicle screening and enforcement along the I-90/94 corridor.	Increase in number of vehicles screened along the I-90/94 Corridor

3.2.3 Evaluation Approach

The approach to be taken in evaluating each of the objectives for this project is described as follows in Table 3.2-2.

Table 3.2-2: WIM Evaluation Approach

Objective	MOE	Evaluation Approach
2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	Total Delay Reduction Queue Delay Reduction	For a sample portable WIM and a comparable portable static scale data will be collected in the field and used to determine the total average delay per vehicle at the inspection site as the average time spent from when the vehicle leaves the freeway to when it re-enters. The average time spent before reaching the scale "queue delay" will also be measured.
	Acceptable scale accuracy	Data from WisDOT's Motor Carrier Inspection Database and the Monthly Inspection Reports will be used to compare the weight recorded from the WIM to the weight recorded at the static scale for vehicles that were pulled aside for further inspection.
2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	Reduction in operating costs associated with delay	The value of time associated with the average total delay measured will be determined.
	Reduction in Personnel Costs Reduction in Maintenance Costs	Interviews with WisDOT State Patrol Staff will be used to gather and compare personnel and maintenance cost data for the portable WIM scales, portable static scales and permanent WIM scales.
3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	Increased Number of Citations for Overweight Violations	Data from WisDOT's Motor Carrier Inspection Database and the Monthly Inspection Reports will be used to determine the number of citations per month issued before and after the deployment of the portable WIMs. The number of citations issued per month at a sample portable WIM will also be compared to that issued at a comparable portable static scale.
	Increase in Enforcement of Safety Violations due to Portable WIM	Data from WisDOT's Motor Carrier Inspection Database and the Monthly Inspection Reports will be used to determine the percentage of the vehicles that are cited at the Portable WIMs initially for overweight violations that are also cited for safety violations.
4.2 Optimize operational efficiency of goods and people movement on existing facilities.	Increased Weigh Station Throughput	For a sample portable WIM and a comparable portable static scale the average number of vehicles passing through the inspection site within an hour will be determined and compared.
5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration of technology.	Increase in number of vehicles screened along the I-90/94 Corridor	Data from WisDOT's Motor Carrier Inspection Database and the Monthly Inspection Reports will be used to determine the number of vehicles screened at portable WIM sites that directly impact the I-90/94 corridor.

3.2.4   Evaluation Test Plans

There are three main tasks to be completed in the evaluation of the Portable WIM Systems:

- Analysis of Motor Carrier Inspection Data
- Interviews with WisDOT State Patrol Staff
- Field Data Collection and Analysis

The plans for completing each of these tests are described in the following sections.

3.2.4.1   Analysis of Motor Carrier Inspection Data

- **Goal Tested:** This test will be used to evaluate goals 2, 3, and 5

- **Data Collection:** Data will be collected from WisDOT's Motor Inspection Database and from the Monthly Inspection Reports prepared by the Wisconsin State Patrol.
- **Data Analysis:** The MOE s to be determined and the methods that will be used to determine them are described as follows:

  - Increased Number of Citations for Overweight Vehicles – The WisDOT Motor Inspection Database will be used to determine the average number of citations per month in 2002 for the portable static scale sites. The average number of citations for a sample portable WIM site will then be determined using the monthly reports and compared to this value. In addition, the total number of overweight citations for one month before the deployment of the first WIM system will be compared to the number of citations for a month after deployment of all WIM systems.

  - Scale Accuracy – If vehicles weighed at the portable WIM scale are found to be overweight they are pulled over for a final weighing at a permanent scale before being cited. Motor carrier inspection data will be used to compare the weights determined at the portable WIM and static scales for vehicles cited to determine scale accuracy. The static scale will be assumed to measure the accurate weight and the average percent deviation from this value will be determined as the measure of accuracy.

  - Increase in vehicles screened along the I-90/94 Corridor – Based on the monthly inspection reports, the number of vehicles screened at portable WIM sites along the I-90/94 corridor for one month during which the portable scales have been deployed will be determined. This value will be considered the increase in vehicles screened on the corridor resulting from the deployment of the portable WIM systems. Sites that are not located directly on I-90/94 but which can be shown to directly impact it will be included in the measurement.

  - Increase in safety violation citations – The number of vehicles pulled aside for inspection due to screening at the portable WIM sites that were found to have safety violations will be determined from the inspection reports. The percentage of vehicles inspected as the result of the WIM screening that were found to have additional safety violations will then be determined as the increase in safety violation enforcement due to the deployment of portable WIM.

- **Schedule:** Collection and analysis of motor carrier data for the portable static scales will be ongoing. Collection and analysis of data for the portable WIM scales, however, will begin one month after the deployment of the first scale.

3.2.4.2   Interviews with WisDOT State Patrol Staff

- **Goal Tested:** This test will be used to evaluate Goal 2, which addresses the reduction in operating costs.

- **Data Collection:** Individual interviews will be conducted with State Patrol staff to gather information regarding the operating costs for the portable WIM scale sites, the permanent WIM scale sites and the portable static scale sites. This information will include:

    – Number and type of personnel required per site
    – Maintenance costs per site

- **Data Analysis:** The operating costs for the Portable WIM sites will be compared to the costs for the other types of weight screening sites and the results will be summarized.

- **Schedule:** Ongoing throughout the evaluation period.

3.2.4.3   Field Data Collection and Analysis

- **Goal Tested:** This test will be used to evaluate Goals 2 and 4.

- **Data Collection:** A sample portable WIM site and a sample portable static scale site that is at a location with a comparable traffic volume will be selected. The following data will be collected at each of these sites:

  - Wait time in queue for a sample of vehicles
  - Time elapsed from leaving to re-entering the freeway at the weigh station per vehicle for a sample of vehicles
  - Number of vehicles passing through the scale per hour

- **Data Analysis:** The data collected at each site will be used to determine the following parameters:

  - Average Total Delay – Average of the times elapsed from entering to leaving the weigh stations
  - Average Queue Delay – Average of the sample in queue wait times
  - Weigh Station Throughput – Maximum and average number of vehicles passing through the inspection site per hour.

The values for the portable WIM site will then be compared to those of the static scale site to determine the change in delay and weigh station throughput.

- **Schedule:** Data collection will begin one month after deployment of the WIM scales.

3.2.5 Additional Evaluation Activities

Institutional Issues Evaluation

This activity will describe any institutional challenges encountered in achieving cooperation between the partners involved in the portable WIM system purchase and deployment including:

- Portable WIM site selection and site preparation
- Funding Issues
- Vendor selection
- Coordination between law enforcement agencies

Information for this task will be gathered through interviews with personnel at the agencies involved with the WIM purchase and deployment.

Lessons Learned Report

This activity will address the technical and institutional issues encountered in integrating ITS components during the purchase and deployment of the WIM systems including:

- Problems encountered with the WIM system hardware
- Problems with encountered with the WIM system software
- Problems with staff training
- Integration with legacy systems and existing infrastructure

Information for this activity will be gathered through interviews with Wisconsin State Patrol personnel.

3.3 Portable Changeable Message Sign Purchase

3.3.1 Project Description

The I-90/94 ITS Earmark provided funding for WisDOT to purchase Portable Changeable Message Signs (PCMS) to be used to provide traveler information on traffic incidents, special events and advanced warning for construction projects. Twenty solar powered LED portable CMS, ten (10) solar powered Hybrid portable CMS and nine (9) portable remote control base stations were purchased and were distributed to WisDOT Districts 1, 5, 6.

3.3.2 Goals, Objectives, Measures of Effectiveness and Hypotheses

The goals and objectives that are applicable to this project as well as the hypotheses and measures of effectiveness to be used in evaluating whether the purchase of the portable CMS effectively achieved these goals are outlined in Table 3.3-1.

Table 3.3-1: Purchase of Portable CMS - Goals, Objectives, Hypotheses, and MOE

Goal	Objective	Hypothesis	MOE
1. Enhance Mobility and Accessibility	1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	The use of PCMS will increase the availability of traveler information.	– User Perception of the availability of PCMS – User perception of the benefits of PCMS – User perception of legibility and clarity of messages
2. Enhance Productivity	2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	PCMS will provide useful information to drivers, helping them safely avoid delays due to incidents, construction, etc.	– User perception of travel time reduction – User perception of reliability of information – User Perception of usefulness of information
	2.2 Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.	Drivers will use the information provided on PCMS to improve their travel planning.	– User perception of usefulness of information for travel planning
	2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	PCMS will allow WisDOT personnel to more effectively manage the effects of traffic incidents, special events and construction thereby reducing operating costs.	– Perception of WisDOT personnel of the reduction in operating costs
3. Improve Safety	3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	The information shown on PCMS will make drivers more aware of dangerous situations and help drivers avoid them.	– User perception of the safety benefits – Emergency personnel perception of the reduction in collisions, injuries and fatalities – WisDOT maintenance personnel perceptions of reduction in injury due to use of PCMS
	3.2 Improve the average response time of emergency vehicles.	PCMS will help mitigate congestion near an incident, allowing emergency vehicles to access the scene more quickly.	– Emergency personnel perception of the reduction of response time
	3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents	Information provided on PCMS will help drivers avoid incident areas thereby reducing the time to respond and clear incidents,	– Emergency personnel perception of reduction in response and clearance times
4. Increase Efficiency	4.1 Reduce time delay and costs associated with congestion	PCMS will help drivers avoid incidents and congestion, reducing travel time and operating costs.	– User perception of delay reduction
	4.2 Optimize operational efficiency of goods and people movement on existing facilities.	The use of PCMS will allow WisDOT to better manage traffic on the Interstate allowing for increased efficiency.	– WisDOT personnel perceptions of the benefits of PCMS in optimizing operational efficiency
5. Develop an Intercity Transportation System that most effectively Supports the Optimal Deployment of Appropriate Technologies	5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration of technology.	PCMS will be used to provide effective traveler information along the I-90/94 corridor,	– Area of the I-90/94 corridor covered by PCMS

3.3.3 Evaluation Approach

The approach to be taken in evaluating each of the objectives for this project is described as follows in Table 3.3-2.

Table 3.3-2: Portable CMS Evaluation Approach

Objective	MOE	Evaluation Approach
1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	– User Perception of the availability of PCMS – User perception of the benefits of PCMS – User perception of legibility and clarity of messages	– Analysis of Wisconsin Driver Survey Response Data
2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	– User perception of travel time reduction – User perception of reliability of information provided on PCMS – User perception of usefulness of information provided on PCMS	– Analysis of Wisconsin Driver Survey Response Data
2.2 Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.	– User perception of usefulness of information for travel planning	– Analysis of Wisconsin Driver Survey Response Data
2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	– Perception of WisDOT personnel of the reduction in operating costs	– Interview with WisDOT District personnel
3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	– User perception of the safety benefits of PCMS – Emergency personnel perception of the reduction in collisions, injuries and fatalities – WisDOT maintenance personnel perceptions of reduction in injury	– Analysis of Wisconsin Driver Survey Response Data – Survey of Emergency Response Personnel – Interview with WisDOT maintenance personnel
3.2 Improve the average response time of emergency vehicles.	– Emergency response personnel perception of the reduction of response time	– Survey of Emergency Response Personnel
3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents	– Emergency response personnel perception of reduction in response and clearance times	– Survey of Emergency Response Personnel
4.1 Reduce time delay and costs associated with congestion	– User perception of delay reduction	– Analysis of Wisconsin Driver Survey Response Data
4.2 Optimize operational efficiency of goods and people movement on existing facilities.	– WisDOT personnel perceptions of the benefits of PCMS in optimizing operational efficiency	– Interview with WisDOT District personnel
5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration of technology.	– Area of the I-90/94 corridor covered by PCMS	– Interview with WisDOT District personnel

3.3.4 Evaluation Test Plans

There are three main tasks to be completed in the evaluation of the portable CMS:

- Analysis of Data from the Wisconsin Driver Survey
- Interview with WisDOT District personnel
- Survey of Emergency Response Personnel

The plans for completing each of these tests are described in the following sections.

3.3.4.1 Analysis of Data from the Wisconsin Driver Survey

- **Goal Tested:** This test will be used to evaluate goals 1,2,3, and 4

- **Data Collection:** A survey questionnaire was developed by the University of Wisconsin-Madison and mailed in December 2001 to a random sample of 500 drivers in 22 selected Wisconsin counties. This survey contained questions designed to determine user awareness and perceptions of the use of variable message signs in providing traveler information. A description of VMS provided in the survey included a description and pictures of both portable and permanent VMS and while some survey questions refer specifically to portable VMS, some refer to VMS in general. Responses to questions about VMS will be collected from the survey response database for drivers residing at zip codes located within the three districts where the portable CMS purchased were deployed. Since there are no permanent variable message signs located in the three districts where the portable CMS were distributed, it will be assumed that responses to the questions about VMS refer primarily to the users experience with portable CMS.

- **Data Analysis:** A statistical analysis of the data collected from the response database will be performed to determine user perception of the use of the portable CMS to provide information about incidents, maintenance activities, special events and warning of planned construction activities including:

  - Familiarity with variable message signs (including portable CMS**)**
  - Knowledge and Perceptions of CMS including whether they:
    - Improve freeway safety
    - Save driving time
    - Improve travel information
    - Reduce stress caused by driving
  - Availability of CMS on routes traveled most frequently
  - Reliability of traffic information provided on CMS
  - Usefulness of information provided on CMS including information about accidents, emergency situations, roadwork, and special events.
  - How often drivers adjust their travel route based on information provided by CMS
  - Whether drivers would choose to take an alternate route based on information provided by CMS and why they would choose not to
  - How easy it is to see and read the messages on portable CMS
  - How easy it is to understand the messages on CMS

- **Schedule:** Ongoing throughout the evaluation period.

3.3.4.2   Interview with WisDOT District Personnel

- **Goal Tested:** This test will be used to evaluate Goals 2, 3, 4 and 5.

- **Data Collection:** WisDOT District 1, 5, and 6 personnel involved with the purchase and use of the portable CMS will be interviewed by phone or through the use of a short questionnaire distributed by mail or e-mail.

- **Data Analysis:** The responses to the interviews will be recorded and summarized and used to determine the perception of the WisDOT District users of the effectiveness of the portable CMS in providing traveler information including:

  - Costs involved in the use of the portable CMS
  - Locations where the portable CMS are most frequently used
  - Benefits experienced from the use of the portable CMS

- **Schedule:** Ongoing throughout the evaluation period.

3.3.4.3   Survey of Emergency Response Personnel

- **Goal Tested:** This test will be used to evaluate Goal 3, which addresses improvements in safety.

- **Data Collection:** A short questionnaire will be developed and distributed to personnel at law enforcement agencies that respond to incidents on I-90/94 in the Districts where the portable CMS are used.

- **Data Analysis:** The survey responses will be recorded and a statistical analysis will be performed to determine the perception of the emergency responders as to the effectiveness of the portable CMS including:

  - The reduction in incident response and clearance times
  - The effectiveness of the portable CMS in reducing the number and severity of accidents

- **Schedule:** Ongoing throughout the evaluation period.

3.3.5   Additional Evaluation Activities

Institutional Issues Evaluation

This activity will address issues involving the cooperation between WisDOT, emergency responders, and other agencies impacted by the portable CMS purchased including:

- Problems with the procurement and distribution of the portable CMS
- Issues with the process used to determine the locations to deploy the CMS
- Issues involving the storage, transport and on site assembly of the portable CMS
- Issues involving control of the portable CMS including priority for use

- Coordination between WisDOT and the emergency responders in determining the messages to be displayed

Information for this activity will be gathered using interviews with WisDOT personnel and through the survey of emergency response personnel.

Lessons Learned Report

This activity will address the technical and institutional issues encountered during the purchase and use of the portable CMS including:

- Problems associated with the use of the portable CMS equipment
- Issues of compatibility with existing devices and software
- Problems associated with remote communication to the portable CMS

Information for this activity will be gathered using interviews with WisDOT personnel and other users of the portable CMS

3.4 Permanent Highway Advisory Radio for the Hudson "Port-of-Entry"

3.4.1 Project Description

This project involves the purchase of one permanent highway advisory radio (HAR), along with two alert signs and associated yellow flashers. The HAR was installed along Interstate 94 at the "port-of-entry" in Hudson, Wisconsin. The alert signs with yellow flashers were installed to serve traffic in both directions. One sign was installed for westbound traffic near mile point 5.5 on I-94 in Hudson, WI. The second sign was installed for eastbound traffic near mile point 253 on I-94 in Minnesota.

The Wisconsin State Patrol has the primary responsibility to activate and add messages to the HAR, although information can be provided to the State Patrol by other divisions within the Wisconsin Department of Transportation (WisDOT), other law enforcement agencies, and other sources. The signs will generally be activated to warn motorists of dangerous conditions, traffic delays, detours, and maintenance or construction activities.

3.4.2 Goals, Objectives, Measures of Effectiveness and Hypotheses

The goals and objectives that are applicable to this project as well as the hypotheses and measures of effectiveness to be used in evaluating whether the Permanent Highway Advisory Radio purchase effectively achieved these goals are outlined in Table 3.4-1.

Table 3.4-1: Permanent HAR for Hudson "Port of Entry" – Goals, Objectives, Hypothesis, and MOE

Goal	Objective	Hypothesis	MOE
1. Enhance Mobility and Accessibility	1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	Permanent HAR will provide traveler information to users of the transportation system	Coverage area, Improvement in customer satisfaction
2. Enhance Productivity	2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	HAR will provide useful information to drivers, helping them safely avoid delays due to incidents, construction, etc.	User perception of reduction in travel time and delay
	2.2 Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.	HAR will provide current traveler information.	Timeliness of information
	2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	By helping operators plan and reduce travel time, operating costs will decrease.	Operating costs
3. Improve Safety	3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	The information broadcast on HAR will make drivers more aware of dangerous situations and help drivers avoid them.	User perception of reduction in accidents, injuries, and fatalities
	3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents	Information provided on HAR will help drivers avoid incident areas.	User perception of reduction in travel time and delay
4. Increase Efficiency	4.1 Reduce time delay and costs associated with congestion	HAR will help drivers avoid incidents and congestion, reducing travel time and operating costs.	User perception of reduction in travel time, delay, and operating costs
	4.2 Optimize operational efficiency of goods and people movement on existing facilities.	HAR will aid drivers in avoiding congestion and finding an efficient route to their destination.	User perception of reduction in travel time, delay, and operating costs
5. Develop an Intercity Transportation System that most effectively Supports the Optimal Deployment of Appropriate Technologies	5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration of technology.	HAR will be used to provide helpful traveler information along the I-90/94 corridor, especially near the WI / MN border.	Coverage area

3.4.3 Evaluation Approach

The approach to be taken in evaluating each of the objectives for this project is described as follows in Table 3.4-2.

Table 3.4-2: Permanent HAR for Hudson "Port of Entry" Evaluation Approach

Objectives	Measures Of Effectiveness	Evaluation Approach
1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	Coverage area, Improvement in customer satisfaction	- Determine the range of the radio signal - Agency survey to determine frequency of activation, and the ease of use of the system - User survey to determine motorists' perception of the availability of information
2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	User perception of reduction in travel time and delay	- User survey
2.2 Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.	Timeliness of information	- User survey
2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	Operating costs	- User survey - Agency survey
3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities.	Reduction in accidents, injuries, and fatalities	- Agency survey (law enforcement)
3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents.	User perception of reduction in travel time and delay	- Agency survey (law enforcement) - User survey (travel info)
4.1 Reduce time delay and costs associated with congestion	User perception of reduction in travel time, delay, and operating costs	- User survey - Agency survey
4.2 Optimize operational efficiency of goods and people movement on existing facilities.	User perception of reduction in travel time, delay, and operating costs	- User survey - Agency survey
5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration technology.	Coverage area	- Agency survey

3.4.4 Evaluation Test Plans

There are two main tasks to be completed in the evaluation of the Permanent HAR for the Hudson "Port-of-Entry":

- User Surveys
- Agency Surveys

The plans for completing each of these tests are described in the following sections.

3.4.4.1   User Survey

- **Goal Tested:** This test will be used to evaluate goals 1, 2, 3, and 4

- **Data Collection:** Data will be collected from a web site designed to collect survey information from the general public. The survey would consist of a series of questions with multiple-choice answers. The method to inform the motorists of the web site will be determined, but may include:

    - Appending a short message listing the website to the end of every message broadcast by the HAR

    - Attaching a sign listing the web site to the permanent alert signs

    - Listing the web site on adjacent Changeable Message Signs (CMS) when they are otherwise not in use

Additional data about user perceptions may be collected through distribution of a short survey questionnaire to area drivers at locations such as park and ride lots in the vicinity of the HAR location.

- **Data Analysis:** The survey questions will be designed to gather appropriate data and comments from the motoring public. The responses to the questions will be aggregated and analyzed to see if the goals and objectives of the system are being met. MOEs to be determined include the following:

    - User perception of reductions in travel time, delay, and operating costs

    - Usefulness of broadcast information

    - Customer Satisfaction

    - **Schedule:** The website and user survey will be setup as soon as possible. Once the survey system and notification process is activated, the data collection will begin and remain active throughout the evaluation period.

3.4.4.2   Agency Surveys

- **Goal Tested:** This test will be used to evaluate all five goals.

- **Data Collection: Agency** surveys will consist of both general questionnaires and individual interviews, whenever each is appropriate. Some employees, such as those responsible for operating the HAR on a daily basis at the State Patrol may be asked a variety of questions on a number of topics. Others will only be asked a few questions that relate to their specific duties.

    - Surveys and Questionnaires: These can be presented to the appropriate staff as a printed paper copy (via mail, e-mail or fax), as an electronic copy that should be filled out and returned as an email or Microsoft Word document, or via a web page survey (similar to the User Surveys).

- Individual interviews: The interviews can take place over the phone, in person, or via e-mail. This method will be used to gather specific, detailed information from an agency employee.

- **Data Analysis:** As with the user surveys, the agency surveys and interviews will be used to determine if the deployment of the HAR system is meeting the goals and objectives set for it. Some of the MOEs that will be evaluated are:

  - Frequency of use

  - Ease of use of the system

  - Agency operating costs

  - Agency perception of improved safety

- **Schedule:** Ongoing throughout the evaluation period.

3.4.5 Additional Evaluation Activities

Institutional Issues Evaluation

This activity will describe any institutional challenges encountered in achieving cooperation between the partners involved in the permanent HAR purchase and deployment including:

- Permanent HAR site selection and site preparation, including sites for the alert signs.
- Funding Issues
- Vendor selection
- Coordination between law enforcement, maintenance, MnDOT and WisDOT agencies

Information for this task will be gathered through interviews with personnel at the agencies involved with the HAR purchase and deployment. Of special interest will be the coordination between WisDOT and the MnDOT, since one of the alert signs with yellow flashers is located in Minnesota.

Lessons Learned Report

This activity will address the technical and institutional issues encountered in integrating ITS components during the purchase and deployment of the HAR system including:

- Problems encountered with the HAR system hardware
- Problems with encountered with the HAR system software
- Problems with staff training
- Integration with legacy systems and existing infrastructure
- Coordination between WisDOT and MnDOT

Information for this activity will be gathered through interviews with Wisconsin State Patrol and other appropriate WisDOT and MnDOT personnel.

4.0 EVALUATION FINDINGS

4.1 Laptop Computer Purchase

The I-90/94 ITS Earmark provided funding for WisDOT District 6 to purchase laptop computers that were distributed to County Highway Department Patrol Superintendents. The purpose of the laptop computers was to provide county personnel with a means to access weather forecast information remotely, from their vehicle. This would allow the superintendents a better means to predict, provide staff, and respond to weather event and hazardous travel conditions. The computers were also intended to perform other functions for the county superintendents, including remote operation of portable changeable message signs, maintaining remote contact with WisDOT District 6 using e-mail, and input to and retrieval of information from the statewide storm report database. Two tests were conducted for this evaluation, the results of which are described in the following sections:

- Agency User Survey (Section 4.1.1)
- Analysis of Maintenance Data (Section 4.1.2)

4.1.1 Agency User Perception

A survey was distributed to each superintendent in the counties that cover WisDOT District 6. A copy of the survey is provided in Appendix A. The goal of the surveys was to obtain qualitative feedback from the users of the laptop computers, in an effort to determine if the equipment met the objectives of the project from the evaluation plan, including improved accessibility to work-related information, reduced costs, enhanced safety, and enhanced efficiency of operations. The results of the surveys are discussed in the sections that follow.

Survey Responses. Surveys were returned by six of the eight county patrol superintendents in WisDOT District 6: Eau Claire, St. Croix, Chippewa, Pierce, Dunn, and Clark Counties, as shown in Figure 4.1-1:
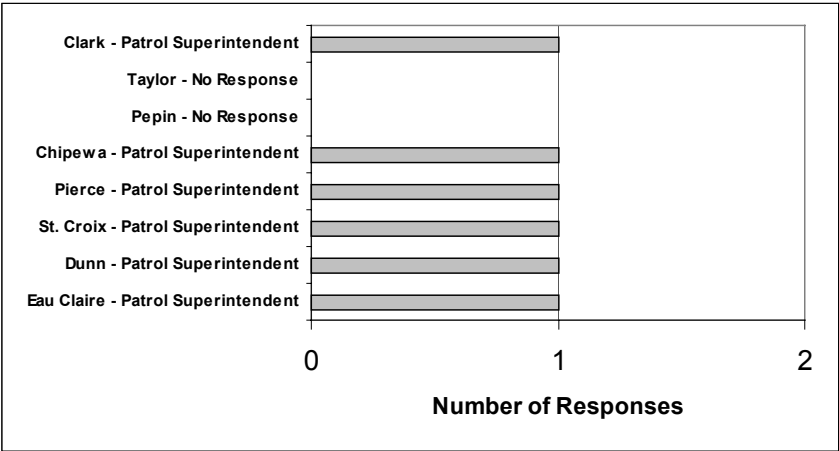

Figure 4.1-1 – Responses to Laptop Surveys, WisDOT District 6 County Patrol Superintendents

Prior Access to Weather Information. The survey asked the county superintendents how they obtained weather information before using the laptop computers. All six superintendents responded that they used the DTN computer.   Use of this network took place only from the county superintendents' offices, not the field. These results are shown in Figure 4.1-2.
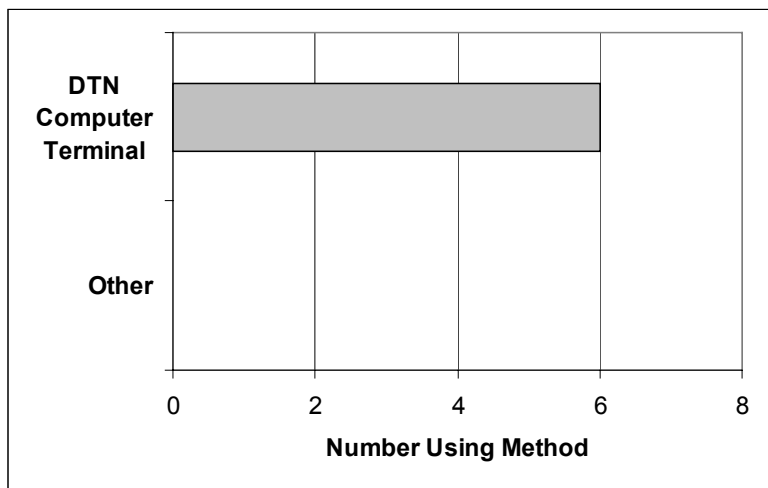
Figure 4.1-2 – Responses to Question 3

(Before purchase of the laptop, how did your agency obtain weather information?

Perception of Improved Access to Weather Information. When asked if the laptop computer enabled easier access to weather information (and if so, how), the responses were: Yes - 3; No - 2, as shown in Figure 4.1-3:
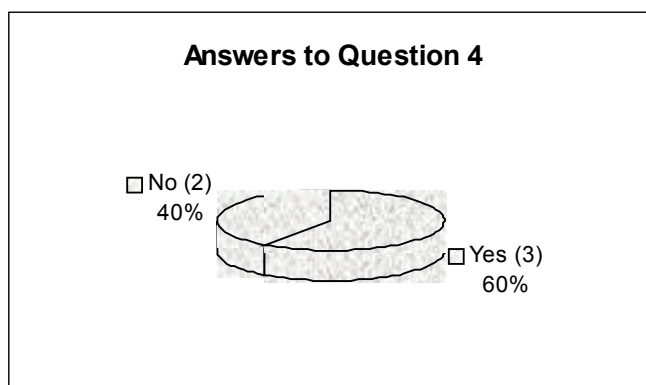
Figure 4.1-3 –Distribution of Answers to Question 4

(Has the laptop made it easier to access weather information?)

One respondent remarked that the laptop computer had better availability than a previous means of accessing weather information, while another respondent commented that the laptop computer now enabled access to weather information from a vehicle. Yet another respondent stated that the laptop computer was "just another source" for the weather information.

Use of Laptop Computers. The survey asked the superintendents whether they used the computer to access information at work, home, and during mobile patrol, and to provide an estimate of the hours per week of use at each location. All five respondents stated that they used the computer at work (office), with

estimated hours per week of use ranging from 1-1/2 to 7 hours (responses with frequencies were: 1-1/2 hours - 1; 2 hours -2; 5 hours -1; and 7 hours -1).

One respondent reported using the laptop computer an average of 4 hours per week from home, and another respondent reported using the computer while on mobile patrol. The respondent stated that the hours estimated for use while on mobile patrol depended upon the weather conditions. The distribution of the use of the laptop computers among the respondents is shown in Figure 4.1-4.
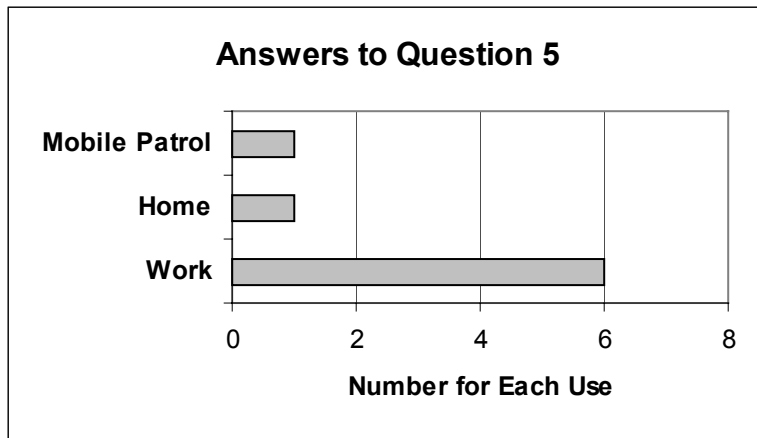
Figure 4.1-4 – Reported Uses of Laptop Computer

Perception of Laptop Effect on Operating Costs. The survey asked to rate the effect of the laptop computer on operating cost in terms of : a) Hours of operation and overtime; b) Use of road salt and deicers; and c) Vehicle fleet maintenance. The requested ratings ranged from : None; Slight; Moderate; and Significant.   The results of the responses are shown in Figures 4.1-5 to 4.1-7 below:
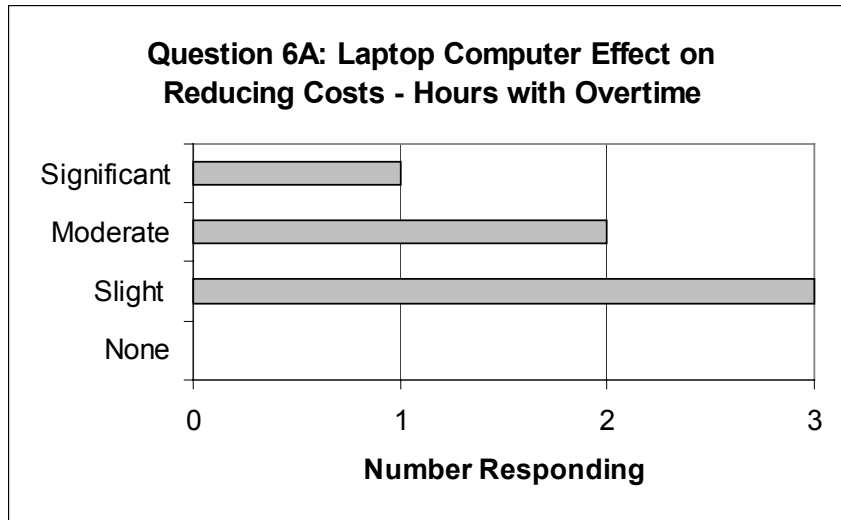
Figure 4.1-5 – Answers to Question 6A

(How much effect has the laptop computer had on reducing operating costs in the area of : Hours of Operation/Overtime?)
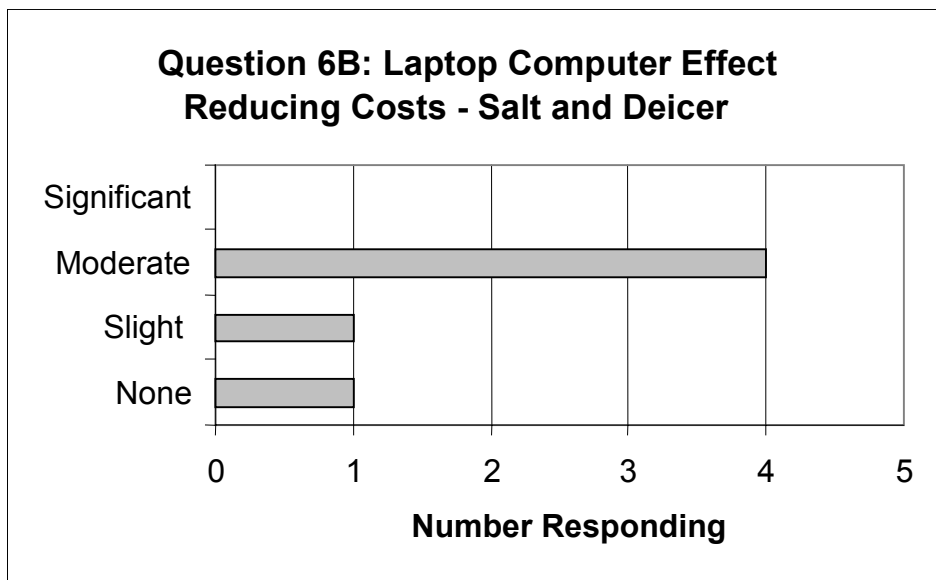
Figure 4.1-6 – Answers to Question 6B

(How much effect has the laptop computer had on reducing operating costs in the area of : Salt and Deicer Use?)

Question 6C: Laptop Computer Effect on Reducing Costs - Vehicle Fleet Maintenance

Significant

Moderate

Slight

None

0   1   2   3   4

Number Responding

Figure 4.1-7 – Answers to Question 6C

(How much effect has the laptop computer had on reducing operating costs in the area of : Vehicle Fleet Maintenance?)

While the responses didn't show a strong opinion about enhancing vehicle fleet maintenance, there was a majority opinion that using the equipment resulted in reduced salt and deicer use and reduced hours of operation. The WisDOT storm report data analysis, presented elsewhere in the report, checked the validity of this hypothesis.
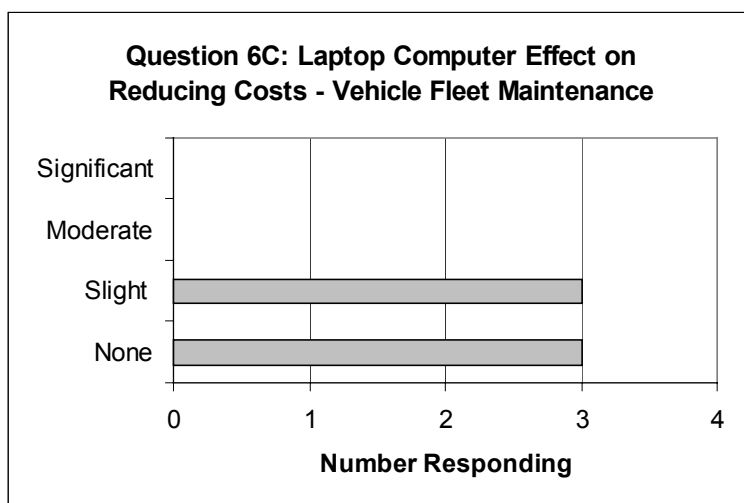
Laptop Computer Impact on Winter Storm Response. The superintendents were asked to judge whether they felt the use of the laptop computers improved their response to winter storms. The possible responses ranged from: a) No improvement; b) Slight improvement; c) Moderate improvement; to d) Significant improvement. Three (3) respondents checked slight improvement, while two (2) respondents checked no improvement. These results are shown in Figure 4.1-8 :

Figure 4.1-8 – Answers to Question 7

Answers to Question 7

Significant Improvement

Moderate Improvement

Slight Improvement

No Improvement

0   1   2   3   4   5

Number Responding
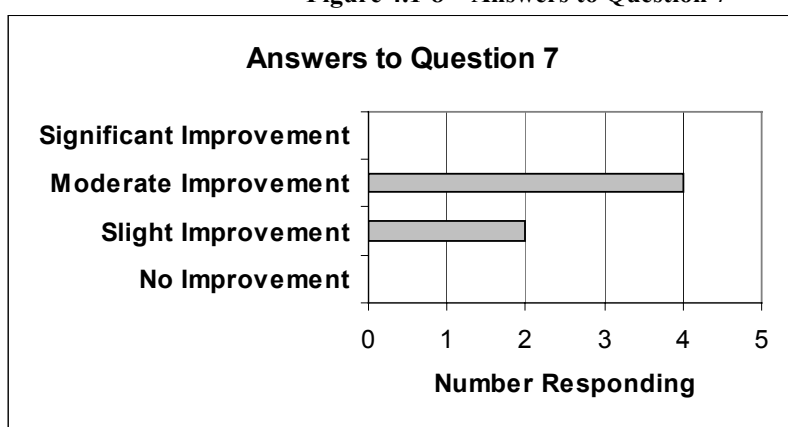
(What impact has the use of the laptop had on your agency's response to winter weather events?)

Other work-related uses of the laptop computers. The superintendents were asked if they used the laptop computer for three additional, specific work-related tasks: e-mail communication with employees; collecting field data; accessing or operating the changeable message signs; and to name any additional work-related use. Their responses and frequencies are shown in Figure 4.1-9:

Answers to Question 8

Other - Producing Storm Reports

Accessing Changeable Message Signs

Field Data Collection

E-mail - Internal and External

0　1　2　3　4　5　6

Number Responding
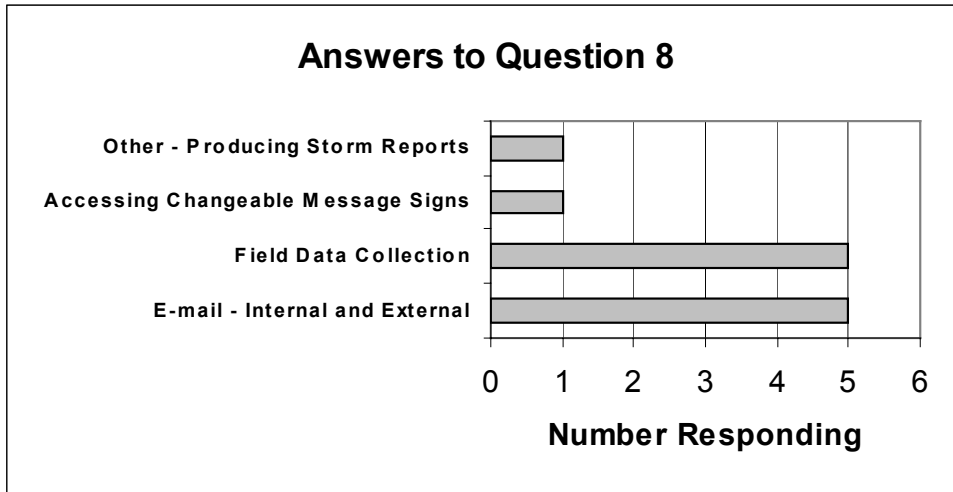
Figure 4.1-9 – Answers to Question 8

(Have you used the laptop for other purposes?)

Sufficiency of laptop computer to meet needs. When asked if the laptop computers were sufficient to meet their needs, five respondents replied, "Yes", and one respondent replied "No" (see Figure 4.1-10):

Answers to Question 9
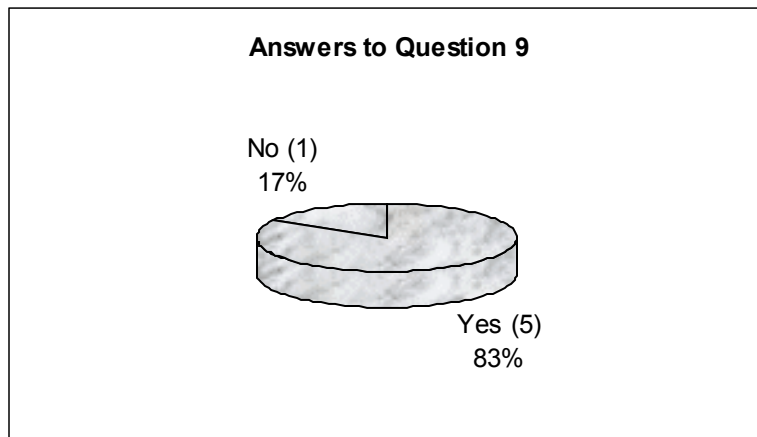
No (1)
17%

Yes (5)
83%

Figure 4.1-10 – Answers to Question 9

(Was the laptop computer sufficient to meet your needs?)

When asked to elaborate why or why not, the responses were:

For those saying the laptop computer met their needs:

    a) "The computer had sufficient power and memory to perform its intended functions."
    b) "More useful compared to other tools such as pagers and cell phones."
    c) "Assisted with communication between the County and State."

For one respondent saying the laptop computer no longer meets his needs:

a) "Age and volume of data has caused problems with the laptop."

Other Comments. The last question on the survey asked the respondents to provide any other comments they had on their experience using the laptop computers. Only one respondent answered:

    a) "The laptop computers are very useful; I expect more reports and programs for using the laptop computer in the future."

4.1.2   Analysis of Maintenance Data

It was desired to investigate the effect of District 6 County Highway Superintendent laptop computer use on improving the efficiency of winter operations.   Storm and operations data for each winter season was available from the WisDOT Extranet site:

https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/index.htm

WisDOT has developed a Storm Severity Index as a tool to compare the multiple factors that determine the resources needed to respond to winter events. The index was introduced in 1995 by the Bureau of Highway Operations, and uses data taken from the weekly storm event reports. The index can be used to compare the relative severity of a winter season in each county or to previous seasons. The criteria used in the index include:

1) Number of snow events;
2) Number of freezing rain events;
3) Total snow amount;
4) Total storm duration; and
5) Total number of incidents.

The winter operation reports also provide summarized data from each District and County on the resources that were used to respond to winter storm events. Such resources included materials, labor, and equipment. The reports contain a disclaimer about the use of the cost data:

> "when looking at winter maintenance costs per lane mile, the reader must consider more than the cost of labor, equipment, materials and administration. Other factors include the local winter severity index, local traffic generators, the mix of highway types and classifications (i.e. urban or rural counties, 18 or 24 hour storm coverage), the type of equipment being used, length of patrol section, etc."

Considering the available information, the most applicable variables to analyze in District 6 for the effectiveness of the Laptop computers are the severity index and the cost per lane-mile for responding to storms in each county. There was available information for one season when the laptop computers were used, 2001-2002. Two seasons of data before the laptop computers were used (1999-2000 and 2000-2001), are also provided in the Appendix.

Trend plots of storm severity index versus cost per lane mile (Figure 4.1-11) and total snowfall versus cost per lane-mile (Figure 4.1-12) were made for the seasons before and after laptop computer use, to test the hypotheses that operations costs were lowered:

Trend Plot - Severity Index vs Cost/Lane-Mile

■ Before Laptops $y = 0.0191x + 8.2767$
                      $R^2 = 0.5495$

• After Laptops $y = 0.01x + 19.308$
                      $R^2 = 0.1291$

Severity Index (y-axis): 0.0 to 50.0
Cost/Lane-Mile (x-axis): $500 to $2,000
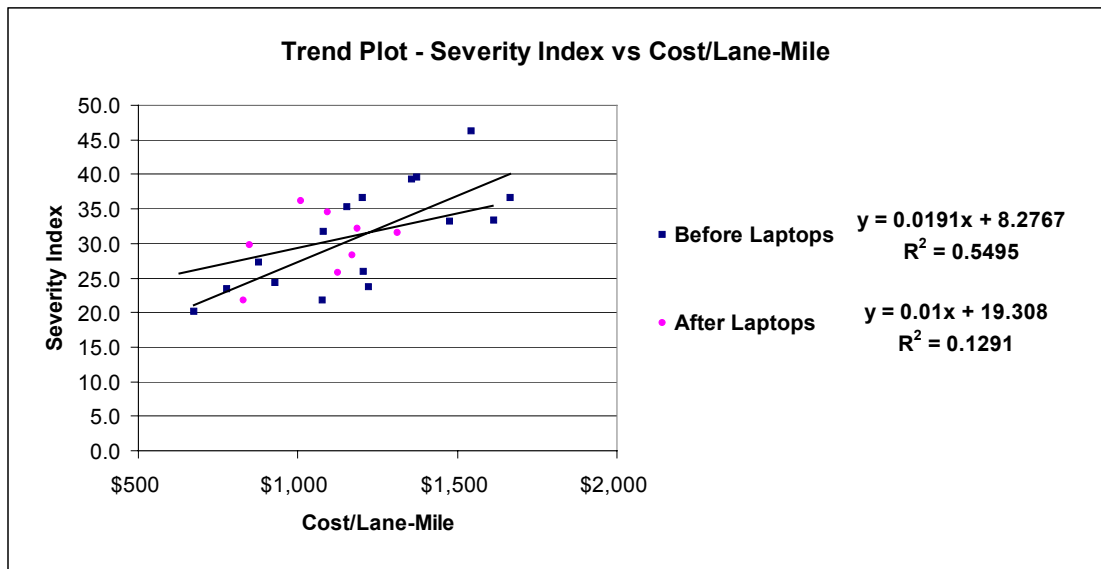
Figure 4.1-11 – Severity Index Vs Cost Per Lane-Mile

Trend Plot - Total Snowfall vs Cost/Lane-Mile

Before Laptops
$$y = 0.0386x + 19.067$$
$$R^2 = 0.3337$$

After Laptops
$$y = 0.0233x + 45.057$$
$$R^2 = 0.1768$$
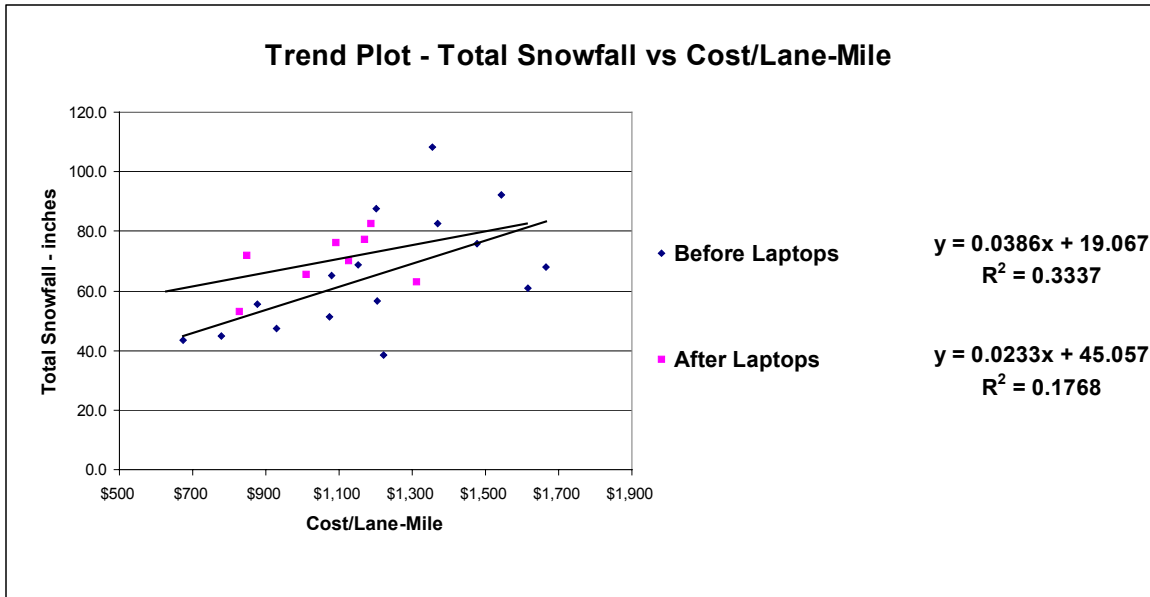
Figure 4.1-12 – Total Snowfall Vs Cost Per Lane-Mile

The trend lines were fit into the data in Figure 4.1-11 and Figure 4.1-12 by using least squares linear regression. The equations are shown on the graphs together with R-squared values (a measure of variability). The trend lines for both graphs tend to have lower slopes for the season when the laptop computers were first used, however, due to a small data population and variability, it can't be said with high certainty that this trend was due to use of the laptop computers.

4.1.3 Summary and Conclusions

The following Table 4.1-1 restates the objectives of the Laptop Computers, and the measures of effectiveness proposed in the Earmark Evaluation Plan for use by County Highway Superintendents responding to weather events and hazardous travel conditions on the I-90/94 corridor in District 6. An overall assessment of the survey results with respect to whether the objectives were achieved, is provided in the third column of Table 4.1-1.

Table 4.1-1 – Laptop Computer Objectives vs. Survey Results County Superintendents

Objective	MOE	Survey Summary Assessment
1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	– Agency User Perception of the Usefulness of the Laptops for Accessing CMS	– Only one survey respondent reported using the laptop computer for accessing the Portable Changeable Message signs.
2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	– Reduction in Operating Costs for Counties for Road Maintenance during weather events	– The strongest response in agreement of reduced operating costs was in the area of lower salt and deicer use (4 of 6 respondents felt there was a moderate reduction) – There was less consensus on reduced overtime hours, with only 2 of 6 respondents indicating moderate reduction and 3 indicating slight reduction. – Reduction in vehicle fleet maintenance had the least consensus regarding improved operations, with 3 of 6 respondents indicating slight cost reduction, and another 3 indicating no reduction
2.4 Reduce the costs and improve the quality of data collection for transportation system planning, use operations, maintenance and installations.	– Agency User Perception of the Reduction in Data Collection Costs	– Most of the respondents (5 of 6) reported using the laptop computer for field data collection, while one respondent reported using the laptop computer for producing storm reports

Objective	MOE	Survey Summary Assessment
3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents 4.2 Optimize operational efficiency of goods and people movement on existing facilities.	– Agency Perception of Incident Management Benefits of Laptops – Agency Perception of Reduced Response time to weather events	– All of the respondents felt that using the laptop computers resulted in either a moderate improvement (4 of 6) or slight improvement (2 of 6) in response to winter weather events

The following additional statements are judged to summarize the results of the surveys of WisDOT District 6 County Highway Superintendents for the use of the laptop computers:

- In general, the laptop computers served the County Highway Superintendents' needs, and made weather information related to their duties responding to storms more accessible to them, in a mobile environment.
- There is insufficient information to determine conclusively that using the laptop computers reduced operating costs. However, the surveyed opinions of the superintendents, at a minimum, indicated a consensus that the units helped moderately decrease the use of salt and deicers.
- The superintendents reported using the laptop computers for additional functions that helped their overall operation, including communicating with other agencies by e-mail, data collection, preparing storm reports, and operating the portable changeable message signs

4.1.4 Institutional Issues Associated with Achieving Cooperation

Since the laptops were used only by county personnel primarily for the purpose of accessing weather information, there were no significant issues related to achieving cooperation between agencies. However, it should be noted that one of the superintendents surveyed commented that the ability to use the laptop for e-mail communications "assisted with communication between the County and the State".

4.1.5 Lessons Learned on Issues Encountered in Integrating ITS Components

The laptop purchase did not involve integration with any other ITS components.

4.2   Portable Weigh-in-Motion System

As of the completion of this report, the Portable Weigh-in-Motion (PWIM) System has not been deployed and therefore cannot be evaluated at this time. However, interviews were conducted with three State Patrol Officers involved with the deployment of the PWIM system to determine the status of the PWIM project and to document the problems that were encountered that led to the delay in deployment and any lessons learned. The following is a summary of the main results of these interviews:

- Software Problems – In September 2002 the vendor attempted to calibrate the PWIM system. When weights measured by the PWIM system were compared to those taken at the official weigh scale were compared, it was found that there were large discrepancies for some trucks. An adjustment process was conducted by the vendor, which focused on the incorrect steer axle weights provided by the system. It was concluded that there was a problem with the software and the vendor recommended that State Patrol increase the weight of vehicles weighed by the PWIMs to compensate for the problem until it could be resolved. State Patrol was advised that for legal reasons they could not make such an adjustment. The PWIM system could therefore not be used until the issues with the software were corrected.

- Hardware Issues – One of the officers interviewed indicated that State Patrol has also had additional concerns about the PWIM equipment, in particular the PIEZO strips that are placed on the roadway. These strips can only be used for one lane, which limits the effectiveness of the use of the system for six lane divided highways such as I-90/94.

- Deployment Status – State Patrol was able to get the vendor to respond to their concerns about the PWIMs in October 2003. The weight measured by the PWIM software now appears to be within the acceptable range of accuracy. However, due to winter weather conditions, it will not be possible to test the equipment fully until early spring of 2004. If the equipment continues to provide inaccurate weight measurements State Patrol plans to go back to the vendor to make any further corrections to the software.

4.3   Portable Changeable Message Sign Purchase

The I-90/94 ITS Earmark provided funding for WisDOT to purchase Portable Changeable Message Signs (PCMS) to be used to provide traveler information on traffic incidents, special events and advanced warning for construction projects. Twenty solar powered LED portable CMS, ten (10) solar powered Hybrid portable CMS and nine (9) portable remote control base stations were purchased and were distributed to WisDOT Districts 1, 5, 6. The objectives of the Portable Changeable Message Signs included:

- Increase the accessibility of information to travelers in the I-90/94 corridor
- Enhance the productivity of WisDOT staff while handling traffic incidents, construction, and special events
- Enhance safety by reducing the response time to incidents, and providing information to better alert motorists of work zones and other conditions requiring caution

The results of the three tests conducted for the evaluation of the portable CMS are described in the following sections:

- Analysis of Data from the Wisconsin Driver Survey (Section 4.3.1)
- Interview with WisDOT District personnel (Section 4.3.2)
- Survey of Emergency Response Personnel (Section 4.3.3)

4.3.1   Analysis of Data from the Wisconsin Driver Survey

In December 2001 a survey questionnaire developed by the University of Wisconsin –Madison was mailed to a random sample of 500 drivers in 22 Wisconsin counties. The survey contained questions designed to determine user awareness and perceptions of the use of variable message signs(VMS) in providing traveler information. A description of VMS provided in the survey included a description and pictures of both portable and permanent VMS and while some survey questions refer specifically to portable VMS, some refer to VMS in general. Responses to questions about VMS were collected from the survey response database for drivers residing at zip codes located within the three districts where the portable CMS purchased were deployed. Since there are no permanent variable message signs located in the three districts where the portable CMS were distributed, it was assumed that responses to the questions about VMS refer primarily to the user's experience with portable CMS. A statistical analysis of the data collected from the response database was then performed to determine user perception of the use of the portable CMS to provide information about incidents, maintenance activities, special events and warning of planned construction activities.

Survey Responses. The analysis was based on seventy-four (74) responses from zip codes located within WisDOT Districts 1,5,6.

Perceptions of Effectiveness of Variable Message Signs (including Portable CMS). The respondents were asked to circle the number that best represented their feelings about the effectiveness of VMS in terms of a) Improving Freeway Safety; b) Saving Driving Time; c) Reducing Collisions; d) Improving Travel Information; e) Reducing stress caused by driving. Respondents could choose from a scale of numbers from 0 to 4, with 0 indicating that VMS was not effective, and 4 indicating that it was highly effective.
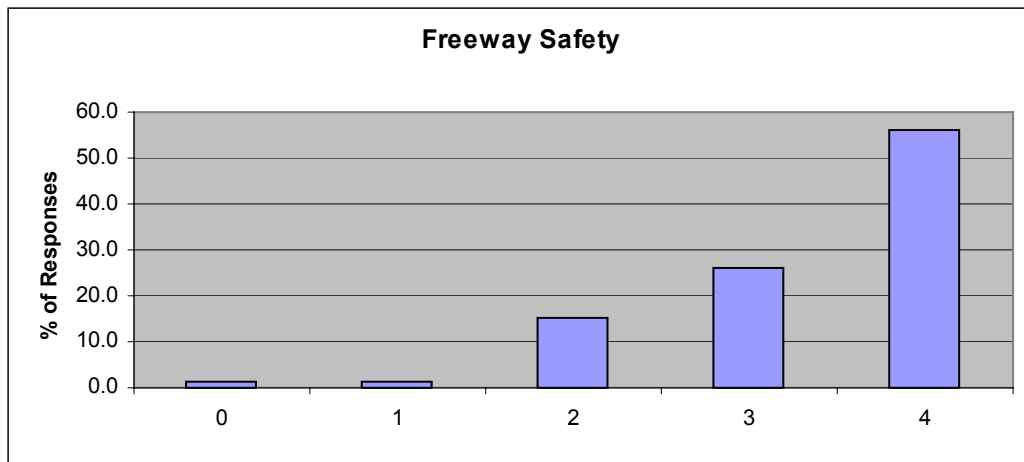
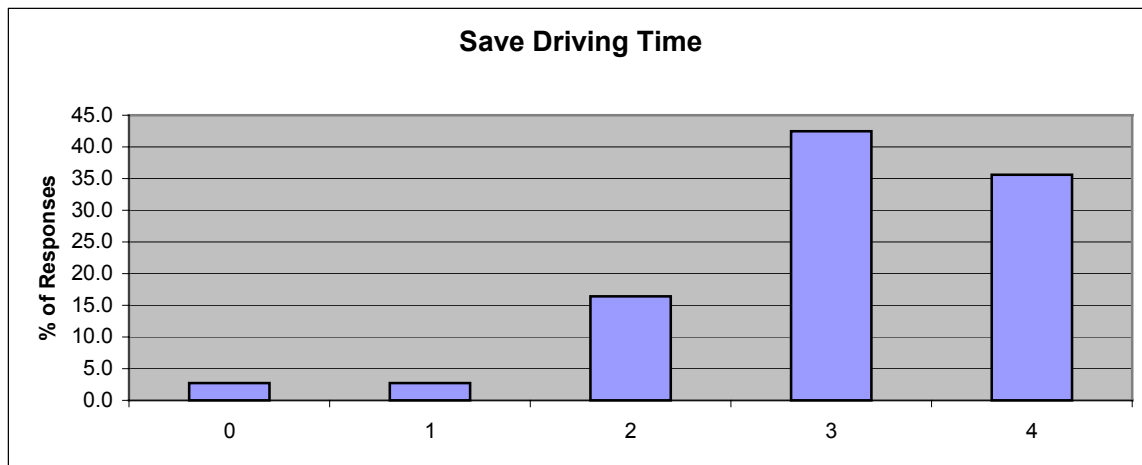**Figure 4.3-1 – Effectiveness of VMS for Improving Freeway Safety**

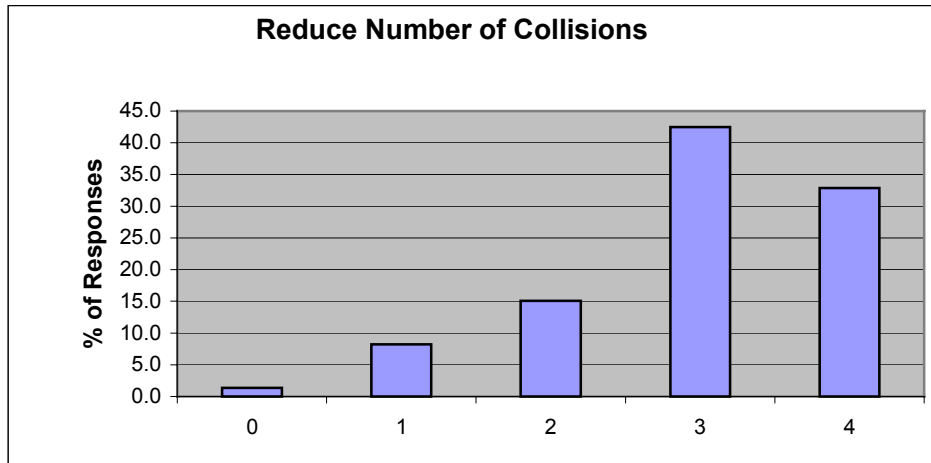**Figure 4.3-2 – Effectiveness of VMS for Reducing Driving Time**

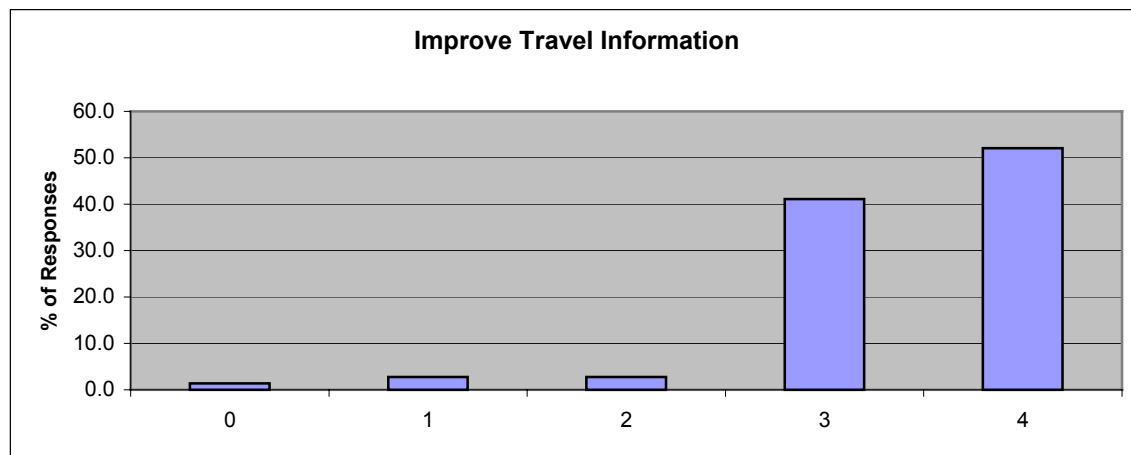**Figure 4.3-3 – Effectiveness of VMS for Reducing Collisions**

Figure 4.3-4 – Effectiveness of VMS for Improving Travel Information

Figure 4.3-5 – Effectiveness of VMS for Reducing Stress

Presence of VMS (including Portable CMS) on routes most frequently traveled. Respondents were asked if there were any Variable Message Signs on the routes they traveled most frequently. 45.8% responded that there were none, 50.0% that there were signs and 4.2% that they were not sure.

Reliability of traffic information provided on VMS (including Portable CMS). Respondents were asked whether they felt the traffic information provided on VMS is reliable.
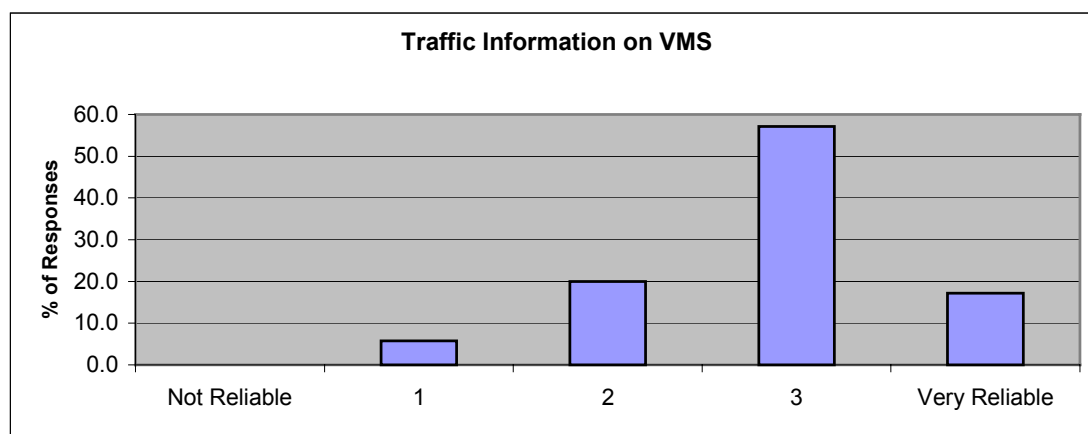
Figure 4.3-6 – Reliability of Traffic Information on VMS

 Usefulness of information provided on VMS (including Portable CMS). Respondents were asked to describe how useful they felt a variety of types of information were when provided on VMS. They could choose from a

scale of 0 to 4, with 0 representing that the information was not helpful, and 4 indicating that the information was very helpful.
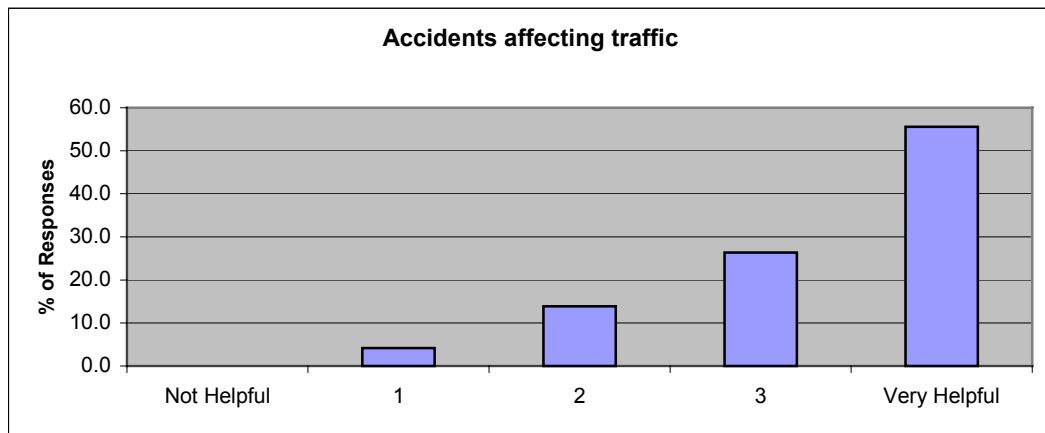
Figure 4.3-7 – Usefulness of Information – Accidents Affecting Traffic
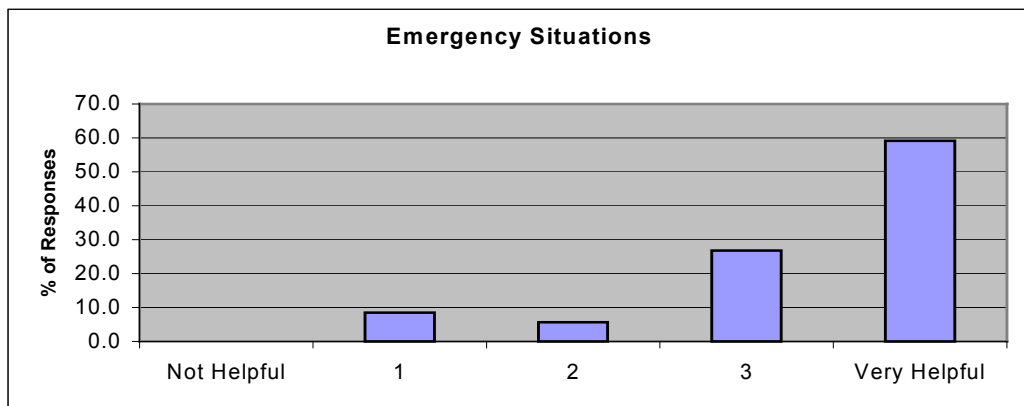
Figure 4.3-8 – Usefulness of Information – Emergency Situations

Current Travel Times
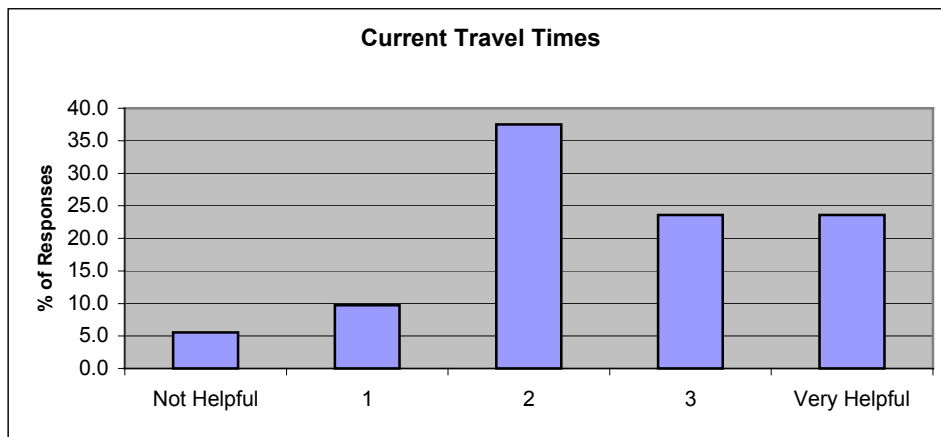
Figure 4.3-9 – Usefulness of Information – Travel Times

Weather Information
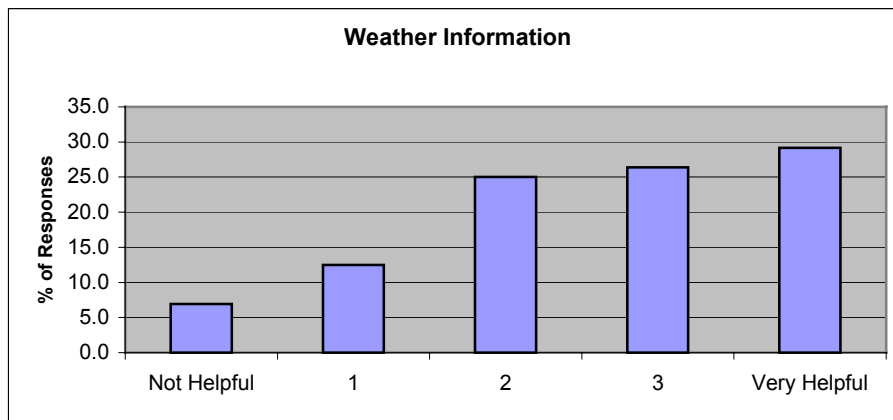
Figure 4.3-10 – Usefulness of Information – Weather

Traffic Congestion
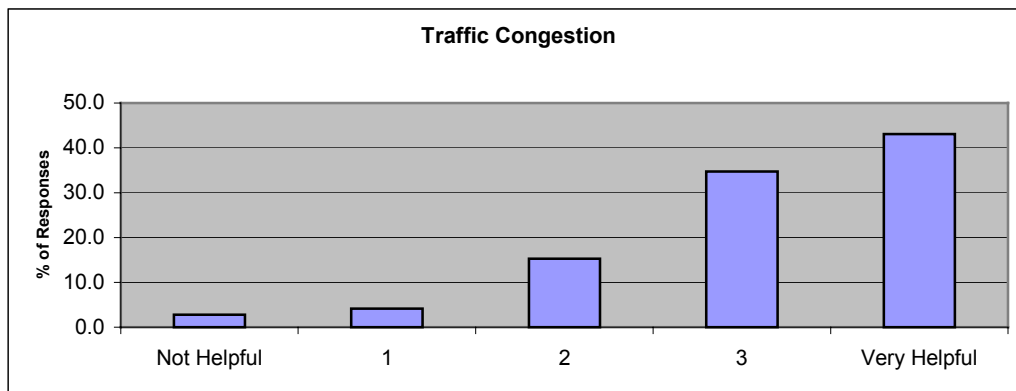
Figure 4.3-11 – Usefulness of Information – Traffic Congestion
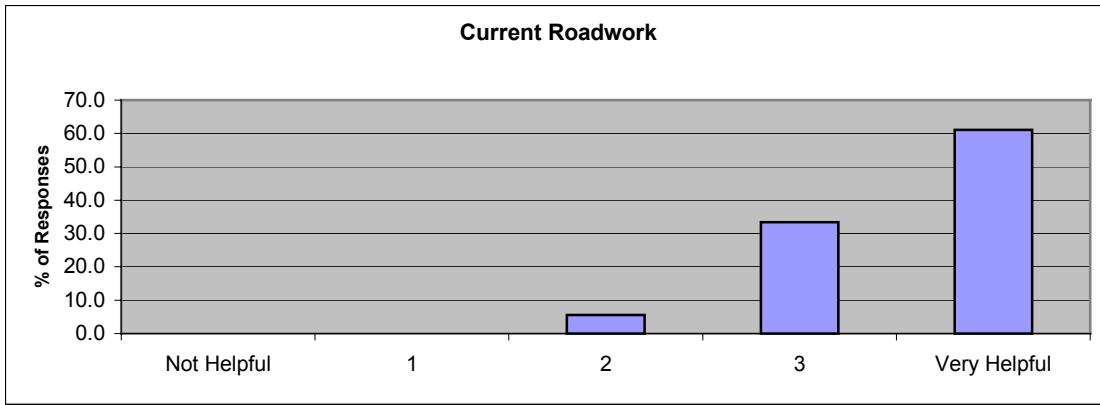
Figure 4.3-12 – Usefulness of Information – Current Roadwork
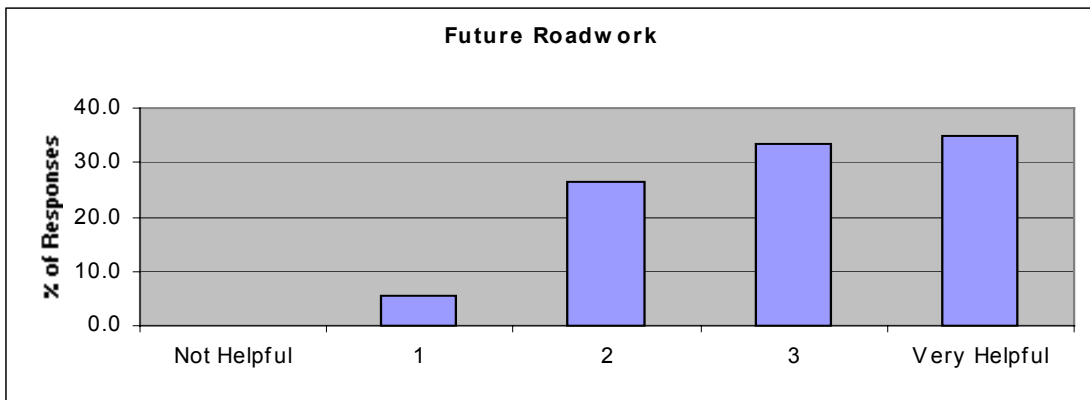
Figure 4.3-13 – Usefulness of Information – Future Roadwork
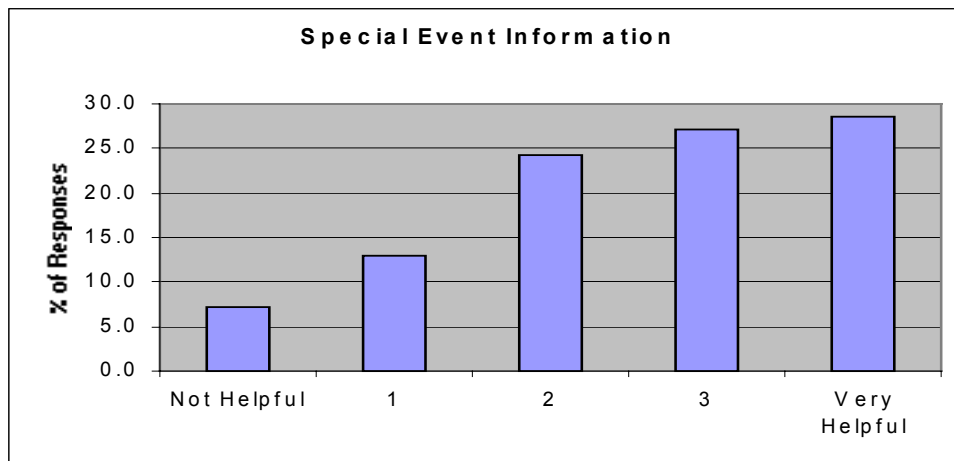
Figure 4.3-14 – Usefulness of Information – Special Events
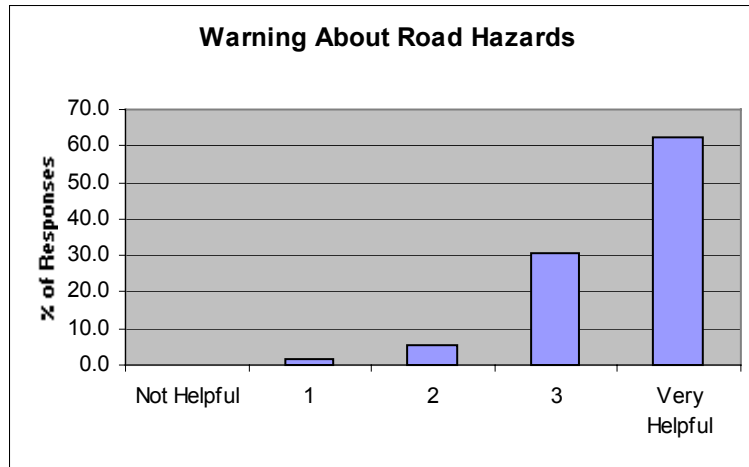
Figure 4.3-15 – Usefulness of Information – Road Hazard Warnings
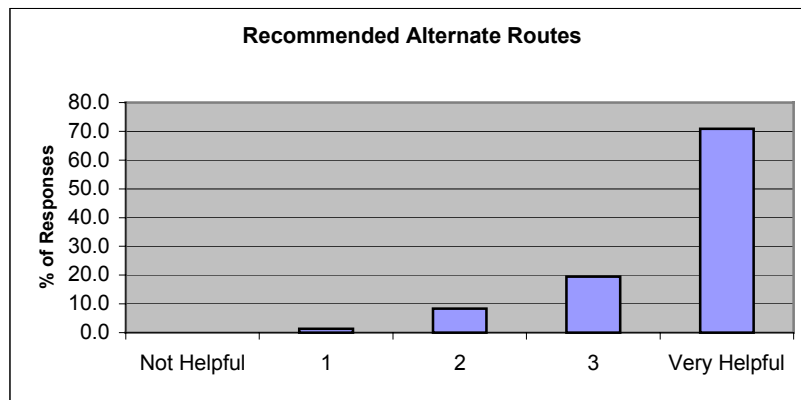
Figure 4.3-16 – Usefulness of Information – Alternative Routes

Travel Route Adjustment. Respondents were asked to estimate the number of times they adjusted their travel routes in a month based on information provided on a VMS (including PCMS) during the winter months and non-winter months.
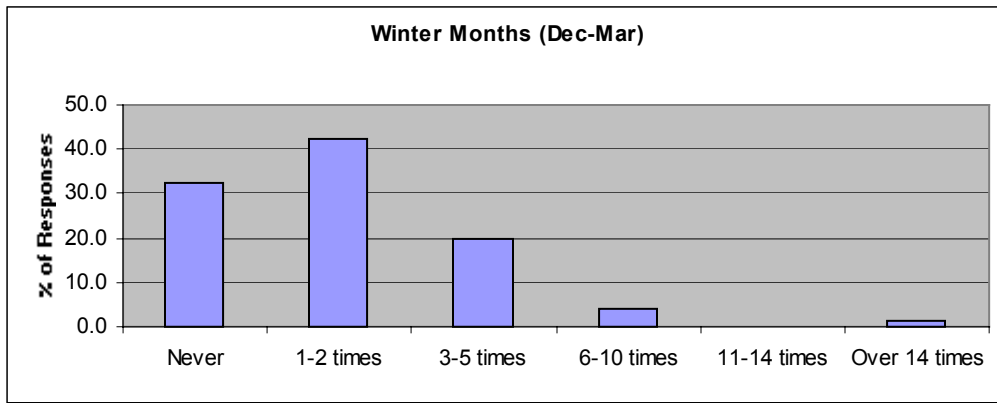
Figure 4.3-17 – Adjustment of Route during Winter Months
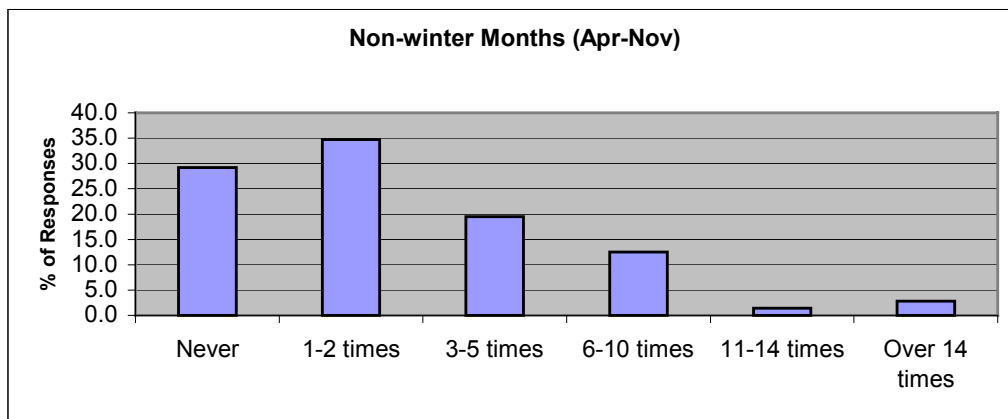
Figure 4.3-18 – Adjustment of Route during Non-Winter Months

48

Ability to see and read messages on portable CMS. Respondents were asked how easy in general it was for them to see and read the messages placed on portable VMS signs placed along the freeway.

Clarity of Portable VMS
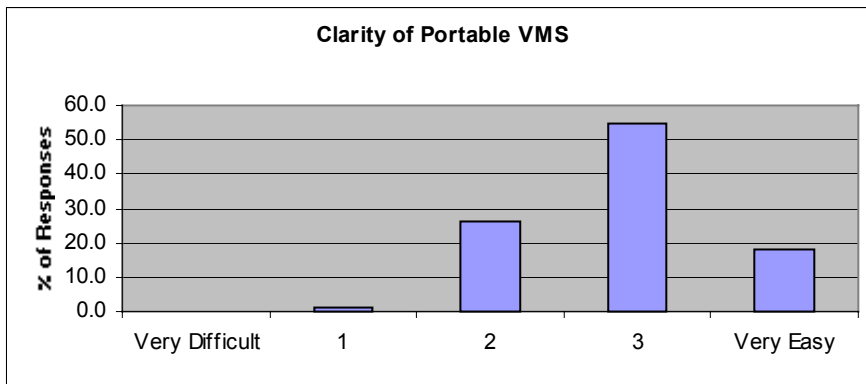
Figure 4.3-19 – Ability to Read and See Messages

Reasons for difficulty in seeing or reading messages on PCMS. If respondents had indicated a problem with seeing or reading the messages on portable VMS, they were asked to indicate the reason. They could choose from the following five reasons:

    a. My view of the sign is blocked by traffic.
    b. The messages are too long.
    c. The messages aren't updated frequently enough.
    d. The messages change too frequently.
    e. The lettering on the sign is too small.

Reasons for Difficulty Seeing/Reading Portable VMS
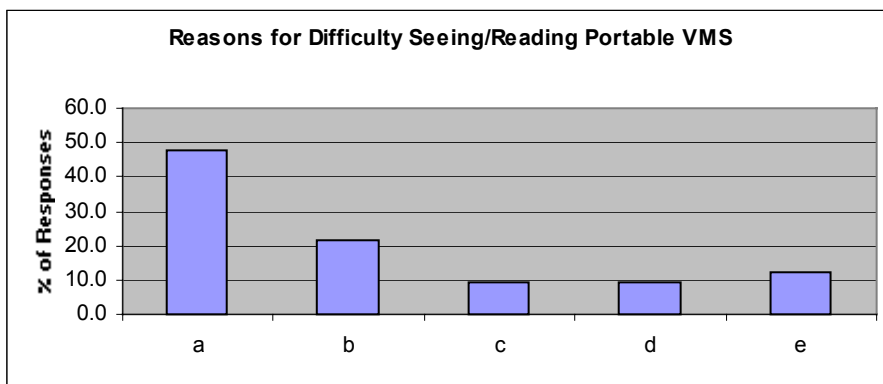
Figure 4.3-20 – Reasons for Difficulty Seeing/Reading Messages

How frequently they are able to read the entire message on PCMS. Respondents were asked to estimate how often they are able to read an entire message on the VMS while driving.

Ability to Read Entire VMS Message
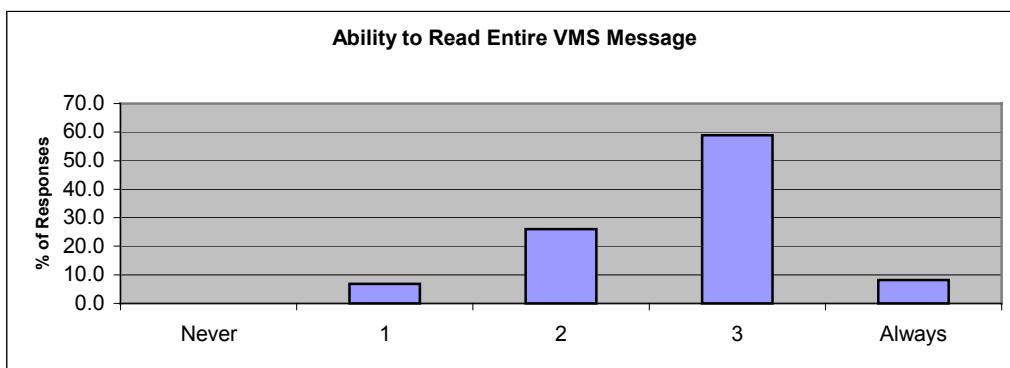
Figure 4.3-21 – Ability to Read Complete Message

Understanding of the meanings of messages. Respondents were asked to describe in general how easy it is for them to understand the meanings of the messages on the signs.

Understanding the Meanings of VMS
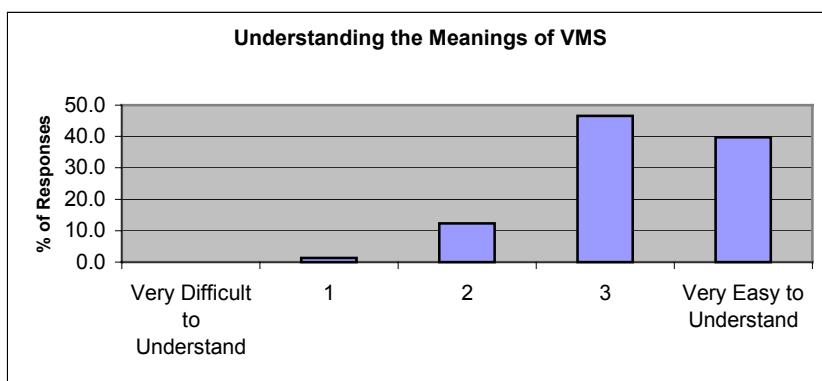
Figure 4.3-22 – Ability to Understand Meaning of Messages

4.3.1.1 Summary and Conclusions

The following Table 4.3-1 restates the objectives for the Portable Changeable Message Sign project, and the measures of effectiveness proposed in the Earmark Evaluation Plan that were tested by the analysis of the Wisconsin Driver Survey data. An overall assessment of the survey results with respect to whether the objectives were achieved is provided in the third column of Table 4.3-1.

Table 4.3-1 – CMS Objectives vs. Results of Analysis of the Wisconsin Driver Survey Data

| Objective	MOE	Survey Summary Assessment
1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	– User Perception of the availability of PCMS	– 50% of users responded that there were VMS on the routes they travel most frequently.
2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	– User perception of travel time reduction – User perception of reliability of information provided on PCMS – User perception of usefulness of information provided on PCMS	– 78% of users felt that VMS would be effective at reducing driving time – 74% of users felt that the information provided on portable VMS is reliable – The majority of users felt that the information provided on VMS is helpful in particular information about current roadwork (94%) , road hazards (93.%), and alternative routes (90%)
2.2 Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.	– User perception of usefulness of information for travel planning	– 42.3% of users responded that on average they had adjusted their travel route based on information on VMS 1-2 times in a month during the winter and 34.7% said they did this during the non-winter months. However, 32.4% (winter) and 29% (non-winter) also responded that they never adjusted their routes based on information on VMS.
3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	– User perception of the safety benefits of PCMS	– The majority of users (75.4%) felt that VMS would be effective for reducing the number of collisions.
4.1 Reduce time delay and costs associated with congestion	– User perception of delay reduction	– 61.7% of users responded that VMS would reduce the stress caused by driving.

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4.3.2 Survey of WisDOT District Personnel

Surveys were distributed to a contact person for each of the WisDOT Districts 1, 5, and 6. A copy of the survey is provided Appendix B. The surveys were passed on to persons in the respective Districts familiar with or responsible for the operation of the portable changeable messages signs. In addition to WisDOT staff, two patrol superintendents from counties in WisDOT District 6 who were familiar with portable CMS operation, also replied to the surveys. The goal of the survey was to determine the perception of WisDOT users of the effectiveness of the signs in meeting the goals of the project.

Survey Responses. A total of eleven individuals provided a response to the survey.   The distribution of responses by title is shown in Figure 4.3-23:
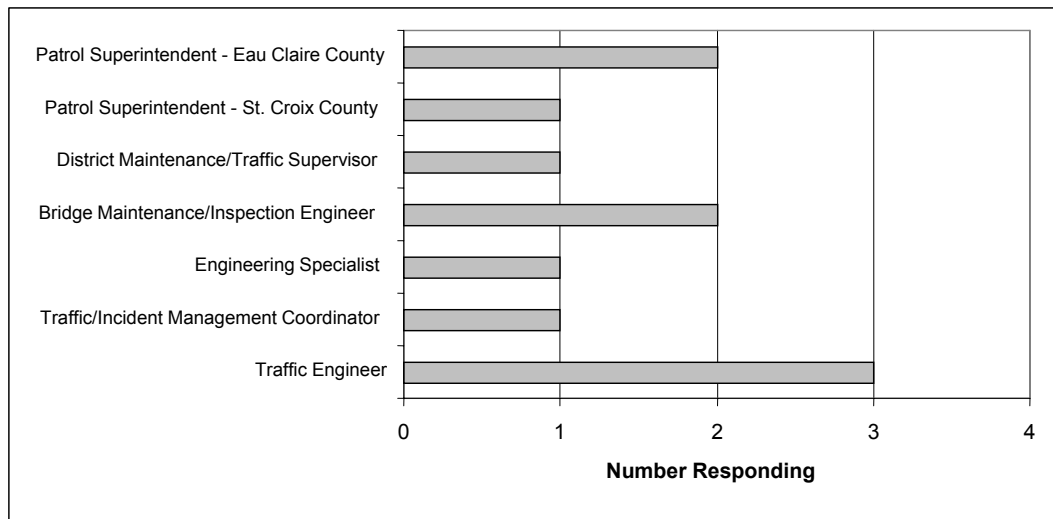
The breakdown of the ten responses by WisDOT District is shown in Figure 4.3-24:
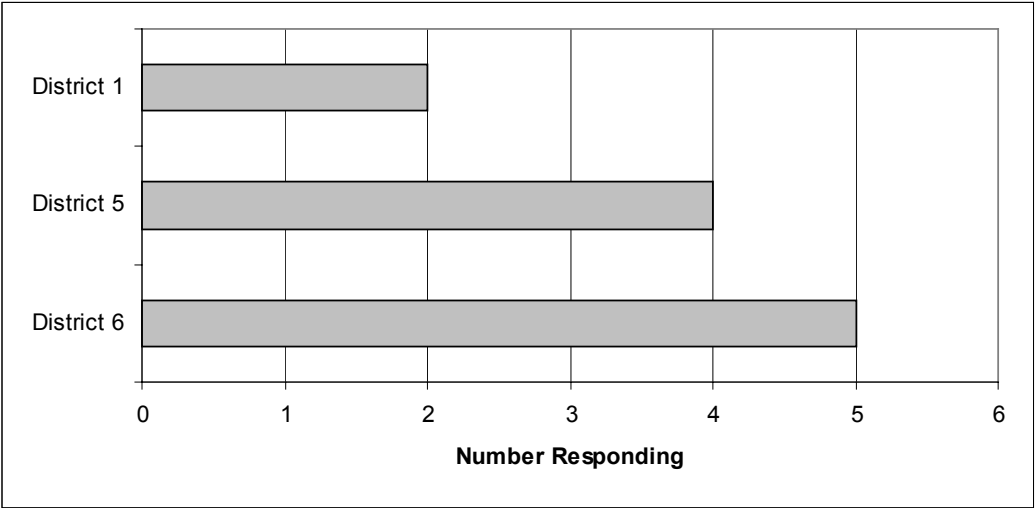
Figure 4.3-24 – Survey Responses by WisDOT District

Familiarity with Portable CMS. The survey asked how familiar the person was with the Portable Changeable Message Signs, with responses ranging from Not at All Familiar (0) to Very Familiar (4). The results of the responses are shown in Figure 4.3-25:

Familiarity with Portable CMS – WisDOT Staff
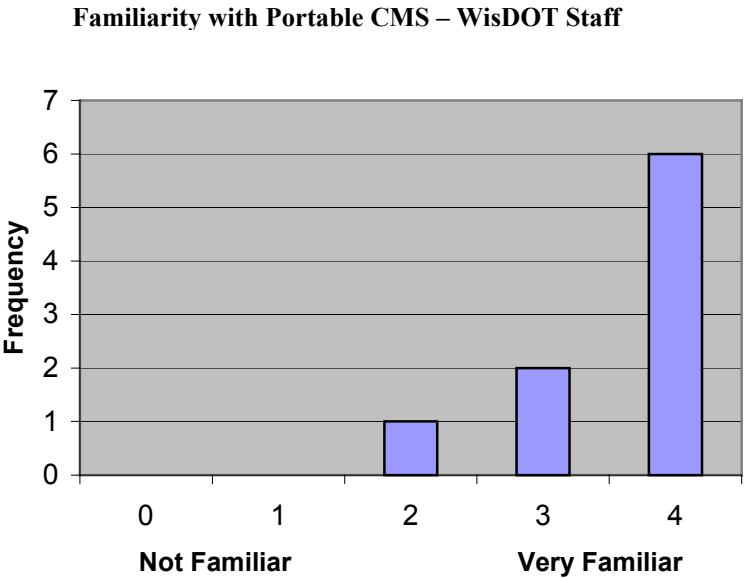
Figure 4.3-25 – Responses to Question 2
(How familiar are you with the Portable Changeable Message Signs?)

Work use descriptions for Portable CMS. The respondents were asked to describe how they worked with or were impacted by the use of the Portable Changeable Message Signs on I-90/94. The responses to this question (with number of identical or similar responses in parentheses) were:

- Deploy and program the CMS (2)
- Provide advance information on alternate routes and delays caused by bridge maintenance (2)
- CMS use has helped notify the motorists of bridge repairs
- Backup CMS coordinator (District 1)
- Post information on the CMS regarding lane closures, alternate routes, and accidents, as part of daily work routine (3)
- The CMS helps protect Work Zone Contractor staff for work on Class I Roads
- Use the Portable CMS to communicate maintenance and highway conditions to I-94 travelers

Perceived Impact of Portable CMS on Operations. The respondents were asked how they felt that the Portable Changeable message signs impacted their operations in the areas of a) Freeway Safety; b) Incident Response Time; c) Incident Clearance Time; d) Travel Time; e) Information to motorists; and f) WisDOT Operating Costs. The possible responses for each item ranged from Worsened (0) to No Change (2) to Improved (4). Responses for each of these six items are summarized in Figures 4.3-26 to 4.3-31:
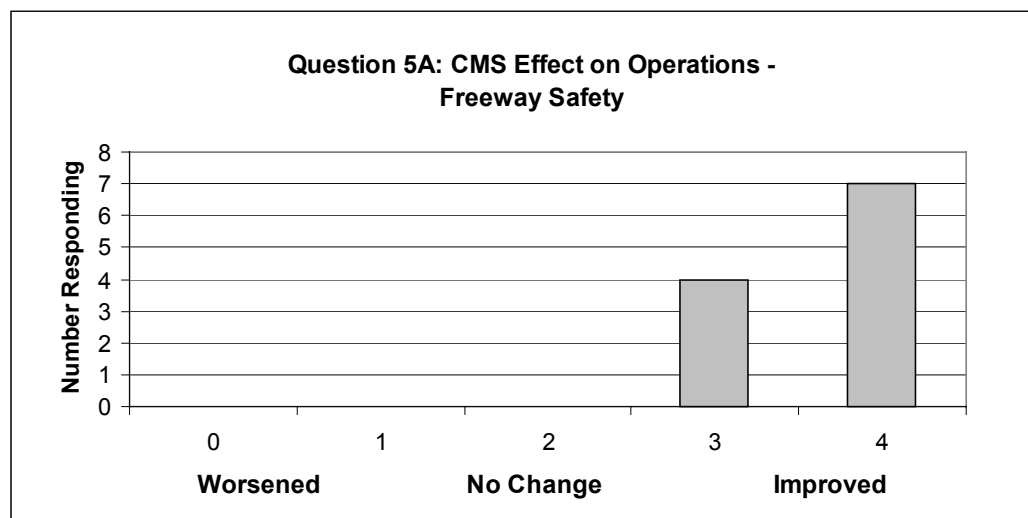
Figure 4.3-26 – Answers to Question 5A

(How much effect has the Portable CMS had in the area of: Freeway Safety?)
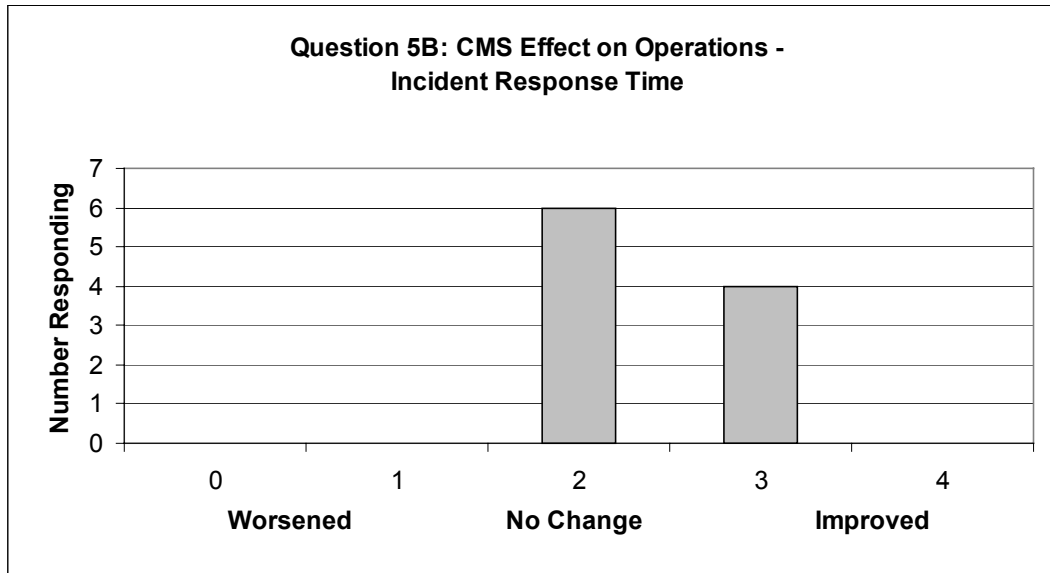
Figure 4.3-27 – Answers to Question 5B

(How much effect has the Portable CMS had in the area of : Incident Response Time)
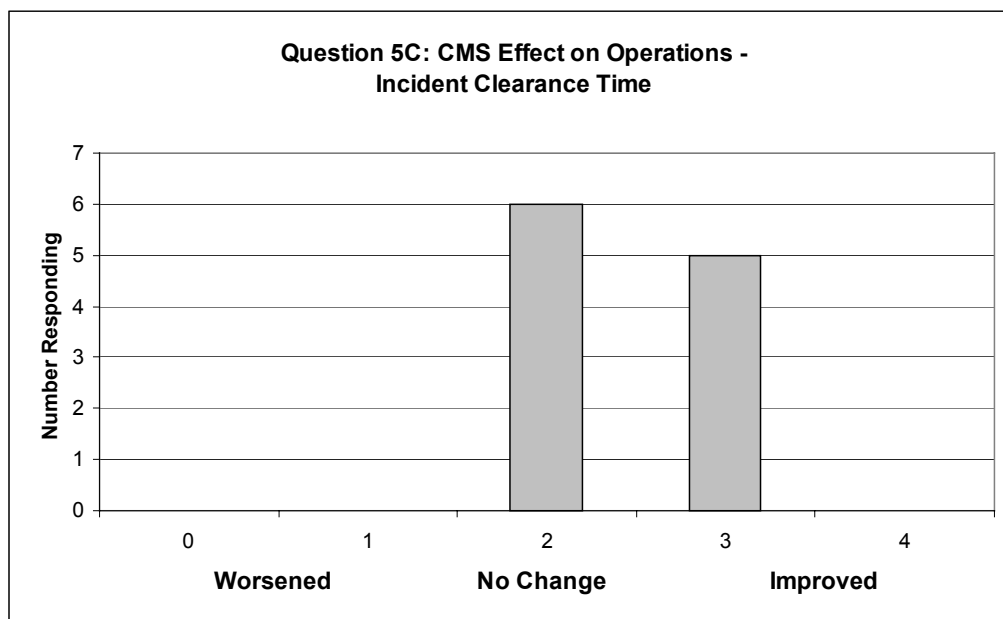
Figure 4.3-28 – Answers to Question 5C

(How much effect has the Portable CMS had in the area of : Incident Clearance Time)

**Question 5D: CMS Effect on Operations –
Travel Time**

Number Responding

0	1	2	3	4
Worsened		**No Change**		**Improved**
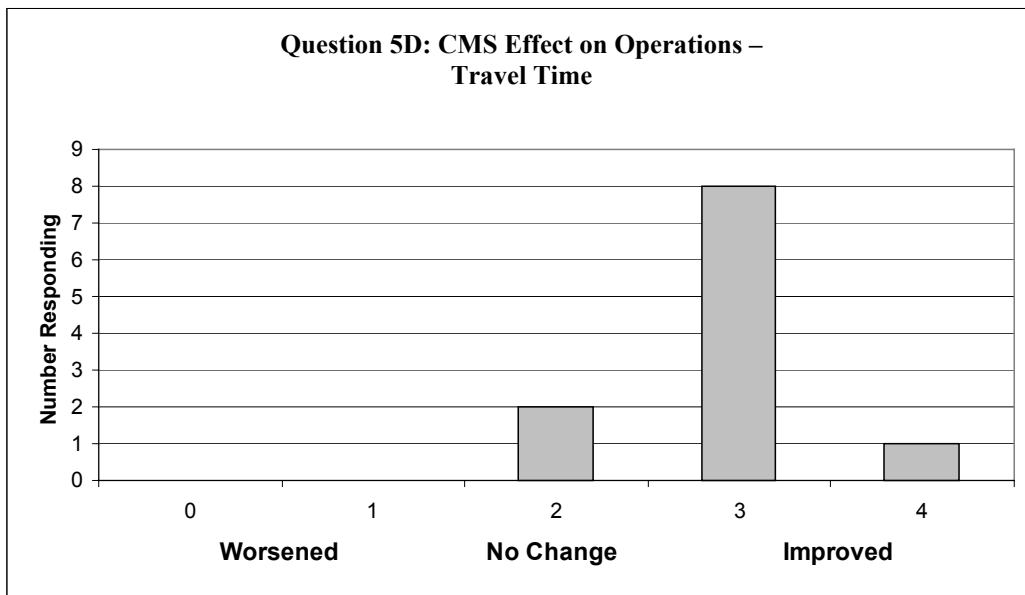
Figure 4.3-29 – Answers to Question 5D

(How much effect has the Portable CMS had in the area of : Travel Time)

**Question 5E: CMS Effect On Operations -
Information to Motorists**

Number Responding

0	1	2	3	4
Worsened		**No Change**		**Improved**
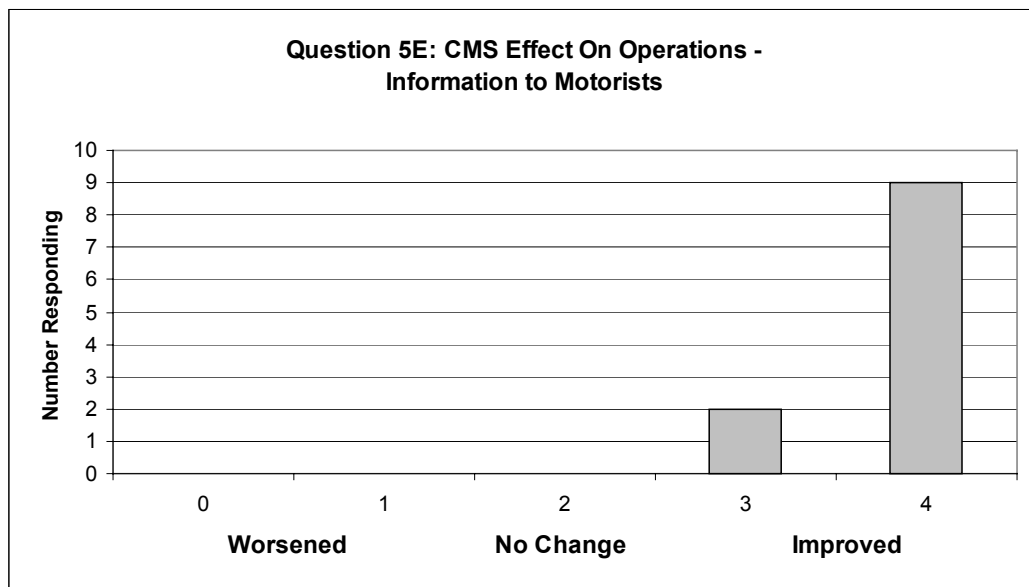
Figure 4.3-30 – Answers to Question 5E

(How much effect has the Portable CMS had in the area of : Information to Motorists)
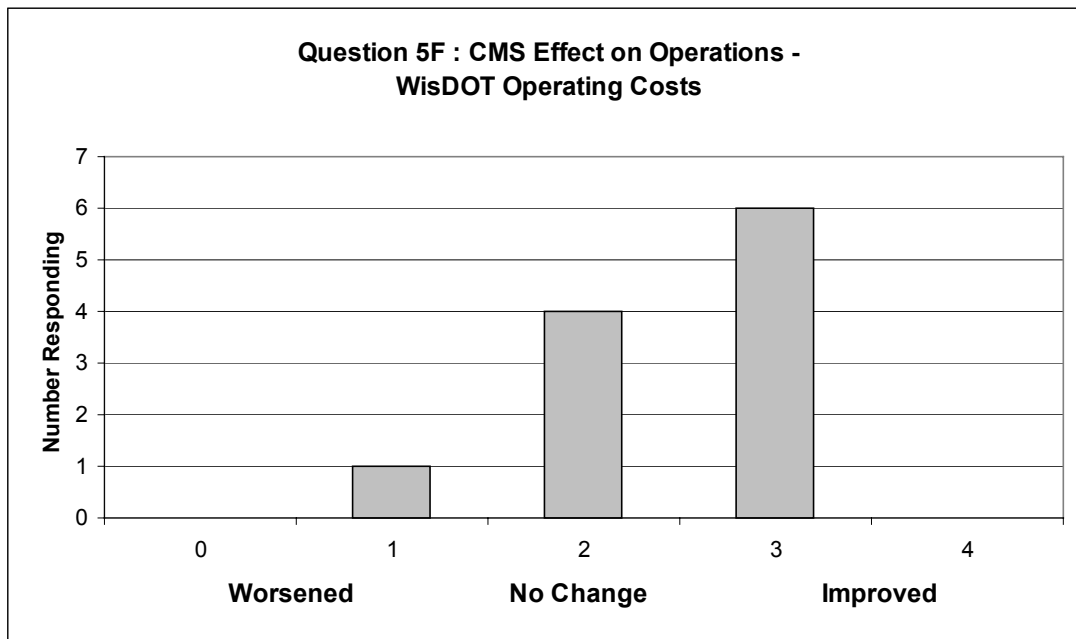
Figure 4.3-31 – Answers to Question 5F

(How much effect has the Portable CMS had in the area of : WisDOT Operating Costs)

Effectiveness of Portable CMS on Improving Conditions on I-90/94. The respondents were asked how effective they felt the portable Changeable Message Signs were on improving conditions on I-90/94, with answers ranging from Not Effective (0) to No Impact (2) to Very Effective (4). The results of the responses to this question are shown in Figure 4.3-32:
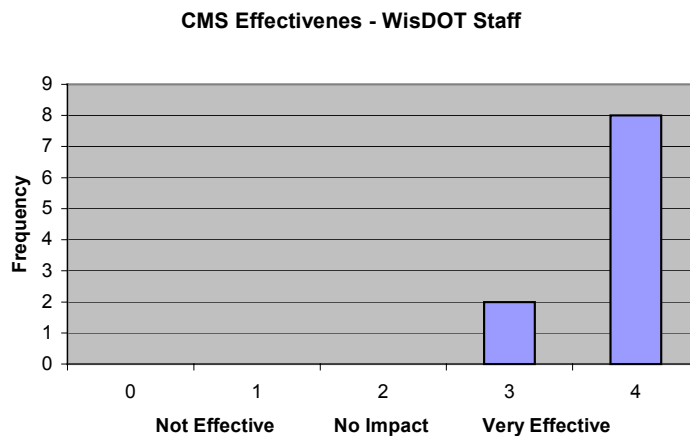
Figure 4.3-32 – Answers to Question 6

(How effective do you feel the Portable Changeable Message Signs have been in improving conditions on I-90/94)

Improvements Observed due to Portable CMS. The respondents were asked to describe specifically how the Portable Changeable Message Signs improved conditions on I-90/94. The responses to this question (with number of identical or similar responses in parentheses) were:

- Fewer calls about maintenance work delaying traffic
- Advance messages allow motorists to plan for alternate routes
- Less motorist frustration, better compliance to work zone traffic restrictions
- Can assign lanes in advance of work area to eliminate last minute changes (2)
- Advance notice of crashes and pavement conditions will improve the safety of those in the work area and the motorists.

Perceived Measures to Improve the Performance of Portable CMS. The respondents were asked what they thought could improve the performance of the portable changeable message signs. The responses to this question (with number of identical or similar responses in parentheses) were:

- Improve readability with brighter LEDs
- Upgrade to "Smart Signs" that provide real time travel information (2)
- Provide a more reliable cellular communication signal (2)
- Provide signs that require less maintenance
- Provide signs with a more user-friendly interface
- Provide greater number of signs for better coverage on I-90/94 (2)

Perceived Usefulness for Job Performance.   The respondents were asked how useful they felt the Portable Changeable Message Signs were in performing their jobs, with responses ranging from Not Helpful (0) to No change (2) to Very Helpful (4). The responses to this question are provided in Figure 4.3-33:

CMS Helpfulness for Job - WisDOT Staff
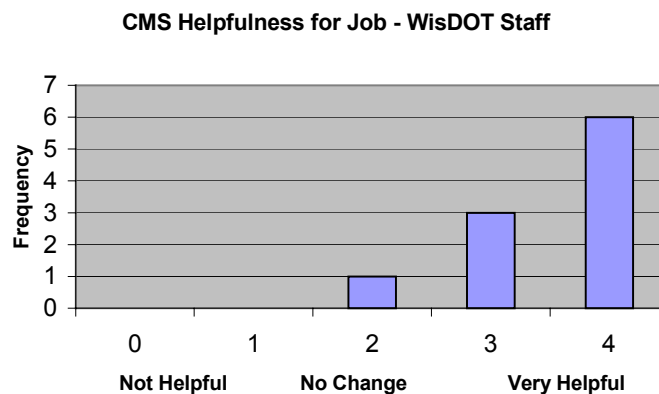
Figure 4.3-33 – Responses to Question 9

(How helpful do you feel the Portable Changeable Message Signs are to you in performing your job?)

Perceived ways that Portable CMS Helped Job Performance. The respondents were asked to specify how they felt the Portable Changeable Message Signs helped them perform their job. The responses to this question (with number of identical or similar responses in parentheses) were:

- Helped alert the public and send out information on alternate routes
- Prevents unpleasant motorist surprises
- Motorists avoiding or slowing at work zones means improved safety for everyone (motorists and workers)
- The Portable CMS gain the motorists' attention better than static signs or Highway Advisory Radio (2)
- Provides information to I-94 travelers on more of a "real-time" basis
- Provides advance notice to motorists on conditions ahead

Recommendations to make Portable CMS more Useful. The respondents were asked to state how they felt the Portable Changeable Message Signs could be made more useful to them. The responses to this question (with number of identical or similar responses in parentheses) were:

- Use more often
- Have a full time CMS coordinator (as in District 1)
- Send messages to (high end) vehicles with telematics displays
- Improve the reliability of the software so on-site confirmation of messages is not required as much
- Have a more reliable remote connection, and include real-time travel information
- Have more user-friendly software
- Use more signs, and establish permanent locations.
- Have signs that require less maintenance

Perceived Effect of Portable CMS on Response to Conditions. The respondents were asked how they felt the use of Portable Changeable Message Signs helped them respond to the following categories of conditions on I-90/94: a) Crashes; b) Special Events; c) Weather Events; d) Planned Maintenance. Responses for each of items are summarized in Figures 4.3-34 to 4.3-37:
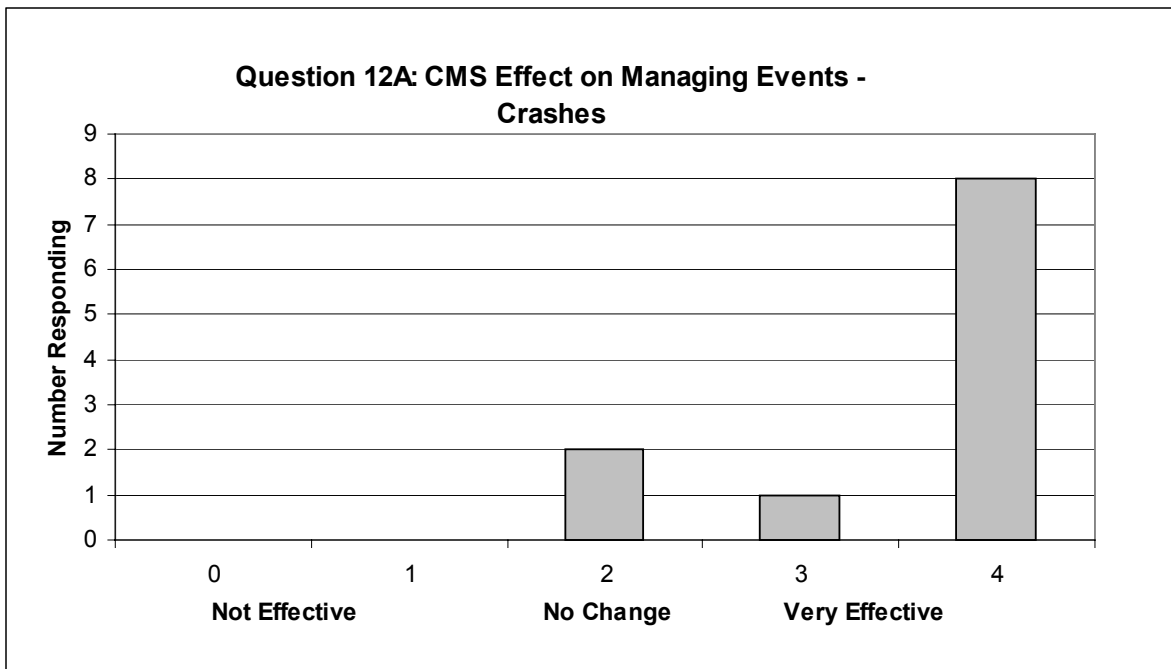
Figure 4.3-34 – Answers to Question 12A

(How much effect has the Portable CMS had for the management of : Crashes)
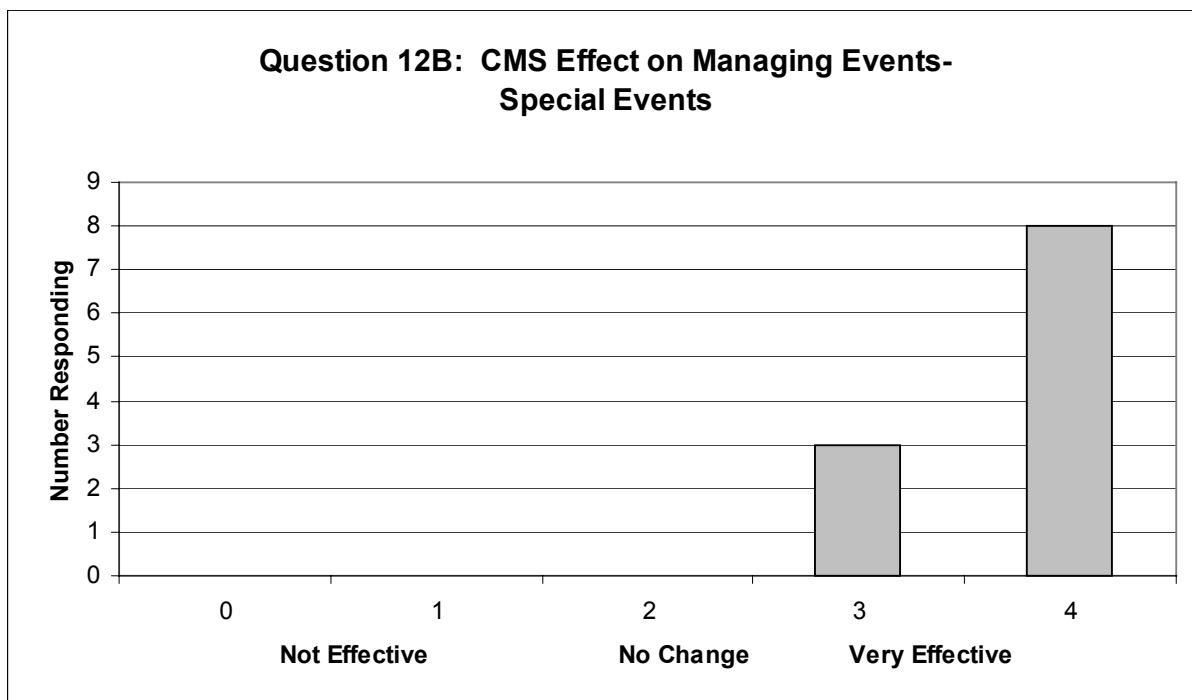
Figure 4.3-35 – Answers to Question 12B

(How much effect has the Portable CMS had for the management of : Special Events)
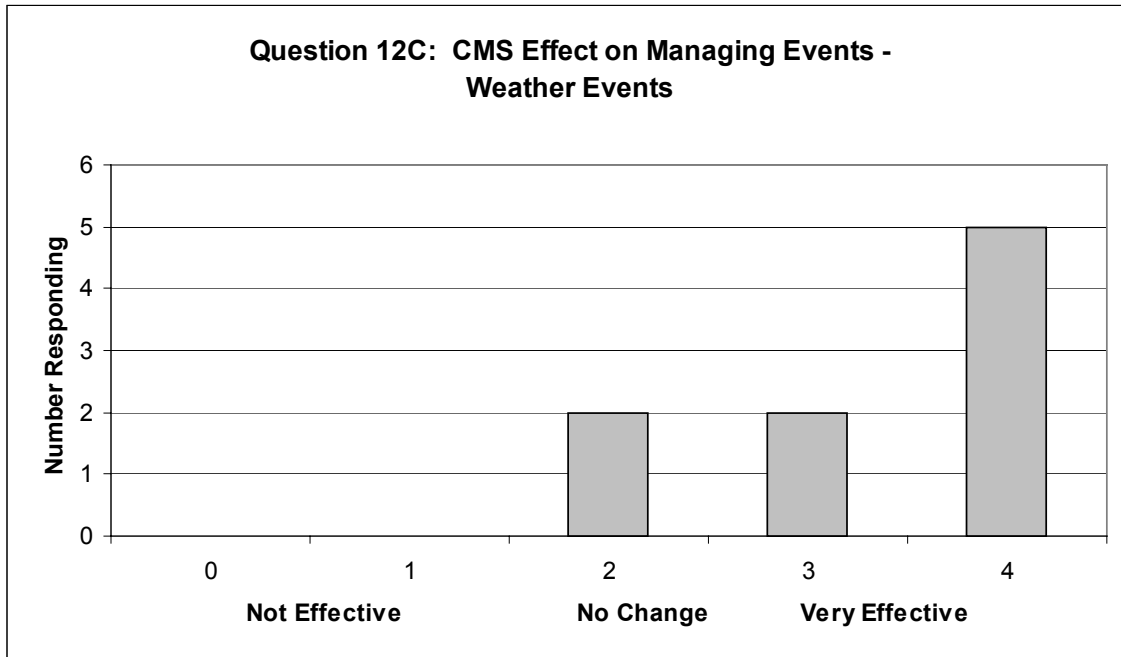
Figure 4.3-36 – Answers to Question 12C

(How much effect has the Portable CMS had for the management of : Weather Events)
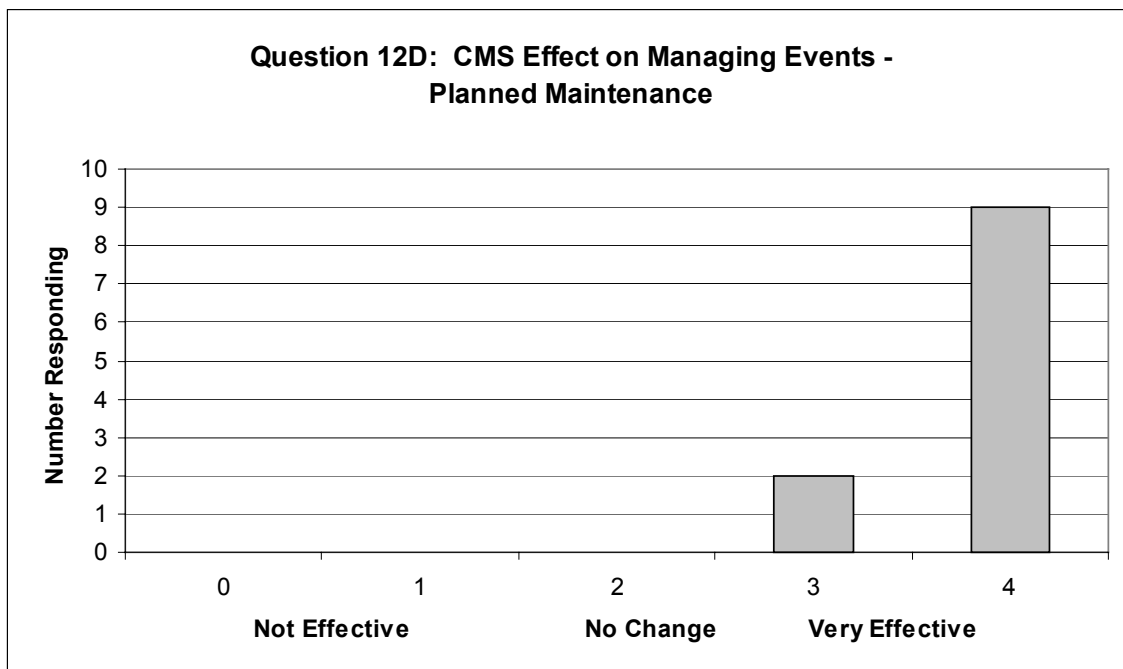
Figure 4.3-37 – Answers to Question 12D

(How much effect has the Portable CMS had for the management of : Planned Maintenance)

Perceived Effect on WisDOT Worker Safety. The respondents were asked how effective they felt the Portable Changeable Message Signs were at increasing safety for WisDOT staff performing maintenance on I-90/94. The possible answers ranged from Not Effective (0) to No Change (2) to Very Effective (4). The responses to this question are summarized in Figure 4.3-38:

Effectiveness of CMS on Increasing Staff Safety - WisDOT Staff
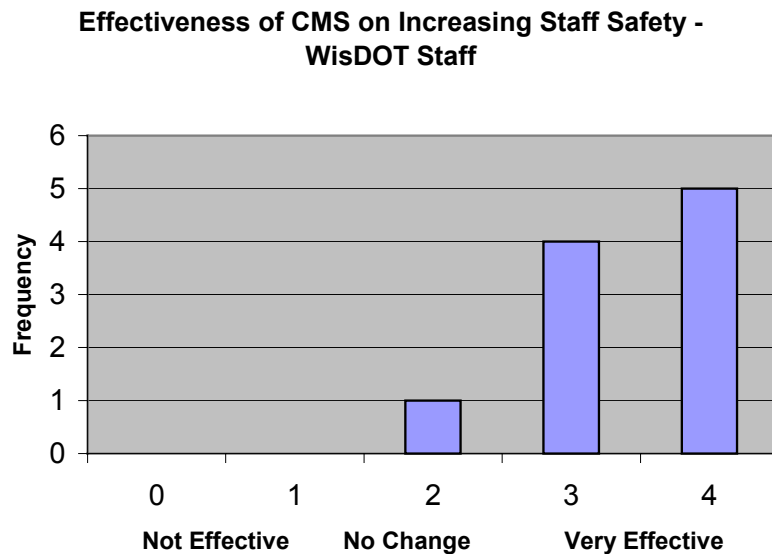
Figure 4.3-38 – Answers to Question 13

(How effective do you feel the Portable Changeable Message Signs are in increasing safety for WisDOT staff performing maintenance on I-90/94?)

Helpfulness of Additional Portable Changeable Message Signs. The respondents were asked how helpful they thought additional Portable Changeable Messages Signs would be on I-90/94, and if helpful, how could they best be used. Seven (7) people responded that additional signs would be more helpful. The responses to this question of how the signs could best be used (with number of identical or similar responses in parentheses) were:

- Set up earlier
- Portable technology is useful for short term projects
- Not useful without real time information
- Use more signs and permanent strategic locations
- Useful, to provide information to both directions of travel
- Need at least two signs to close down I-94 for detour

Reported Problems with Portable Changeable Message Signs. The respondents were asked to describe any difficulties they might have experienced with the use or operation of the Portable Changeable Message Signs. Nine of the eleven people surveyed responded to this question. Their responses concerning problems with the portable changeable message signs (with number of identical or similar responses in parentheses) were:

- The communications link was not always reliable (4)
- Availability with units – advance scheduling not always possible with bridge projects
- Finding a suitable spot for setup
- Need a skilled person to change messages (not always available)
- Some motorists slow down to read messages, but not drivers behind, almost causing crashes
- The hydraulic lift cylinder leaks

Ease of Coordination. The respondents were asked how easy they felt it was to coordinate the operations and use of the Portable Changeable Message Signs with other agencies, with responses ranging from Very Difficult (0) to Very Easy (4). The responses to this question are provided in Figure 4.3-39:

Ease of CMS Coordination with Other Agencies - WisDOT Staff
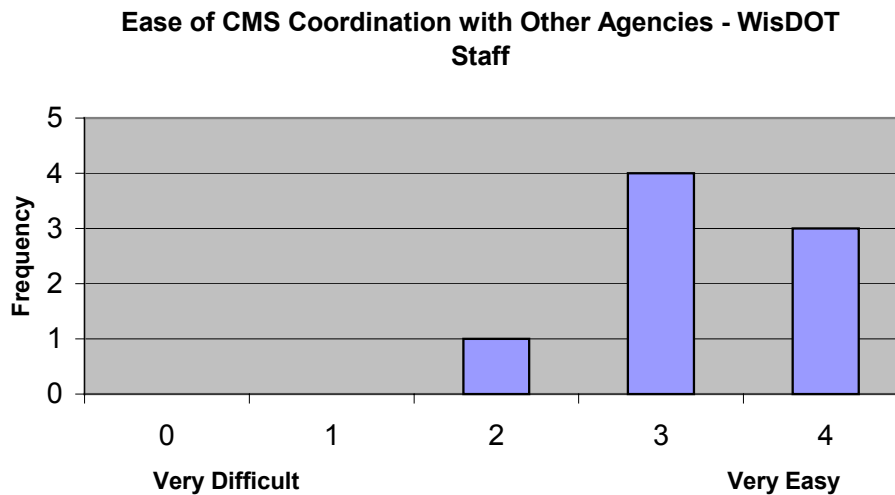
Figure 4.3-39 – Responses to Question 16

(How easy do you think it is to coordinate the operations and use of the Portable Changeable Message Signs with other agencies?)

Coordination problems. The respondents were asked to describe any problems they had in coordinating the use and operation of the Portable Changeable Message Signs. Five (5) of the eleven people responding to the entire survey responded to this question. Their answers (with number of identical or similar responses in parentheses) were:

- WisDOT staff was helpful when assistance was needed (not really stating a coordination problem)
- Forgetting to clear sign message when work, incident is cleared
- Timing of messages to correspond to State Patrol, wrecker response
- Ability to reach people when busy
- State Patrol have tried to alert travelers of incidents using contractor signs (no access)

Internal Coordination Within WisDOT. The respondents were asked if they ever experienced any coordination problems among other staff or WisDOT departments when using the Portable Changeable Message Signs, and if so, to describe the problem. Seven (7) of the eleven people surveyed answered "No", and one person answered "Yes". The one person that answered "Yes" offered the following explanation:

- Need a clearer understanding of when WisDOT uses vs. when the Contractor sets up

Other Comments. The respondents were asked to provide any additional comments they had on the operation of the Portable Changeable Message Signs for the last survey question.   Responses to this question were:

- Useful. Thinks public expects the CMS to be used to the greatest extent
- Fewer angry calls
- Reduced surprise factor
- Very useful tool
- Thinks combination disk/LED sign would give better all-around visibility, when daylight conditions are considered

- Traveling public expects lighted messages with specific content
- Have permanent signs as long term goal
- Travelers give more credibility and will follow Portable Changeable Message Signs vs. static signs
- Need to set up strategically, for proper sight distance
- Makes the work zone safer. People notice active signs more than static signs

4.3.2.1 Summary and Conclusions

The following Table 4.3-2 restates the objectives of the Portable Changeable Message Signs, and the measures of effectiveness proposed in the Earmark Evaluation Plan for use by State Patrol and other emergency response staff in responding to incidents on the I-90/94 corridor. An overall assessment of the survey results with respect to whether the objectives were achieved, is provided in the third column of Table 4.3-2.

Table 4.3-2 – CMS Objectives vs. Survey Results for WisDOT Operations Staff

Objective	MOE	Survey Summary Assessment
2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities	– Perception of WisDOT personnel of the reduction in operating costs	– While over 50 percent of WisDOT staff (6 out of 11 respondents) felt that use of the PCMS provided moderate reduction in operating costs (a rating of 3 out of possible 4 on the survey), this item showed the lowest degree of consensus on how the PCMS improved operations. Consensus was stronger for the PCMS improving other aspects of operation.
3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	– User perception of the safety benefits of PCMS – WisDOT maintenance personnel perceptions of reduction in injury	– There was a strong consensus among the WisDOT staff respondents that the use of the PCMS helped in the response to crashes, improved freeway safety, and improved worker safety in maintenance areas. However, the respondents showed lower consensus (averaging neutral to moderate) on the effectiveness of PCMS on incident clearance time and the general response time for incidents.
4.2 Optimize the operational efficiency of goods and people movement on existing facilities	– WisDOT personnel perceptions of the benefits of PCMS in optimizing operational efficiency	– WisDOT staff respondents indicated a moderate to strong consensus that use of the PCMS improved operations in the following areas: – 1) Motorist travel time (moderate improvement) – 2) Information to motorists (high improvement) – 3) Overall effectiveness (very effective) – 4) Helpfulness for job (very helpful) – 5) Special Events (very effective) – 6) Weather events (very effective) – 7) Planned maintenance (very effective)

The following additional statements are judged to summarize the results of the surveys of WisDOT Operations staff for the use of the Portable Changeable Message Signs:

- WisDOT staff expressed reservations about the reliability of the communication link to the Portable Changeable Message Signs, which was a similar concern for the Emergency Response staff that responded to a separate survey.
- Overall, the WisDOT staff was in agreement with emergency response staff that the Portable Changeable Message signs were a useful and beneficial tool that enhanced the performance of their jobs.
- The WisDOT staff were also in agreement with the emergency response staff regarding the usefulness of additional Portable Changeable Message signs. Specifically, respondents stated that more than one unit is required to properly shut down I-94 for a complete closure and detour, and that for closure in a single direction, having a Portable Changeable Message Sign for managing traffic in each direction would be a great benefit.
- The coordination and institutional issues for WisDOT staff operation of the Portable Changeable Message signs were minimal, however the surveys identified the following areas of concern:
    - The availability of PCMS units for planned maintenance activities (for example, bridge repairs), versus the need to always have the units available for emergencies.
    - The appropriate officials in the field need to call the PCMS operators when an incident is cleared, notifying to clear the message for the incident.
    - The messages for incidents have to be timed to correspond to the actual arrival of the State Patrol and wrecker (tow truck) during response.
    - One respondent mentioned the issue of distinguishing a Contractor's PCMS units and their use from WisDOT PCMS units. Perhaps this issue could be addressed with a standard memorandum of understanding (MOU) among WisDOT traffic management staff, Wisconsin State Patrol staff, and Contractor's for major construction projects involving detours and lane reductions.

4.3.3 Survey of Emergency Response Personnel

Surveys were distributed to a State Patrol contact person for each of the WisDOT Districts 1, 5, and 6. A copy of the survey is provided in Appendix B.   The surveys were distributed to State Patrol staff in the respective Districts familiar with or responsible for the operation of the portable changeable messages signs during incidents and emergency response. The State Patrol officials in these Districts were responsible for using and directing the use of the Portable Changeable Message Signs for responding to incidents and emergencies. The purpose of this survey was to determine the perceptions of emergency response personnel as to the effectiveness of the PCMS in achieving the goals of this project.

Survey Responses. A total of ten (10) state patrol officials responded to the surveys. The distribution of responses by title is shown in Figure 4.3-40:
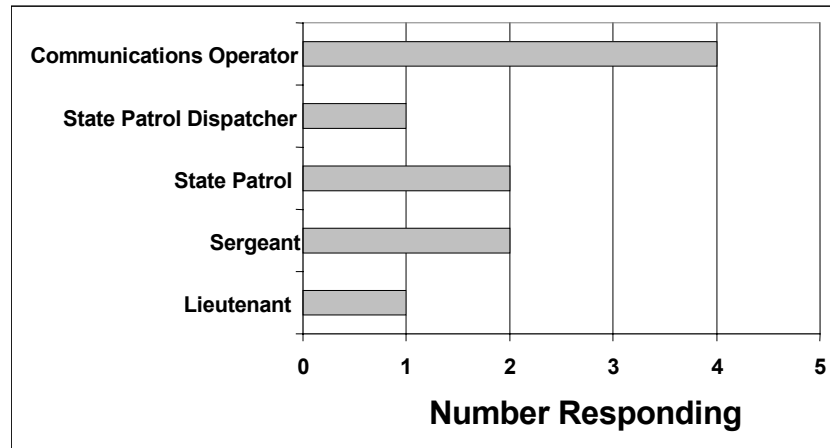
Figure 4.3-40 – Distribution of Answers to Question 1:
(What is your primary job title or function?)

The distribution of survey responses by District is shown in Figure 4.3-41:
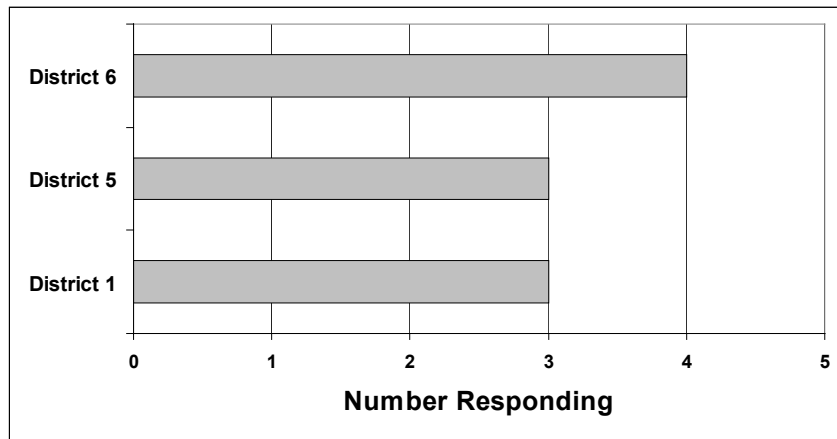
Figure 4.3-41 – Survey Responses by WisDOT District

Familiarity with Portable CMS. The survey asked how familiar the person was with the Portable Changeable Message Signs, with responses ranging from Not at All Familiar (0) to Very Familiar (4). The results of the responses are shown in Figure 4.3-42:

Familiarity with CMS - Emergency Response Staff
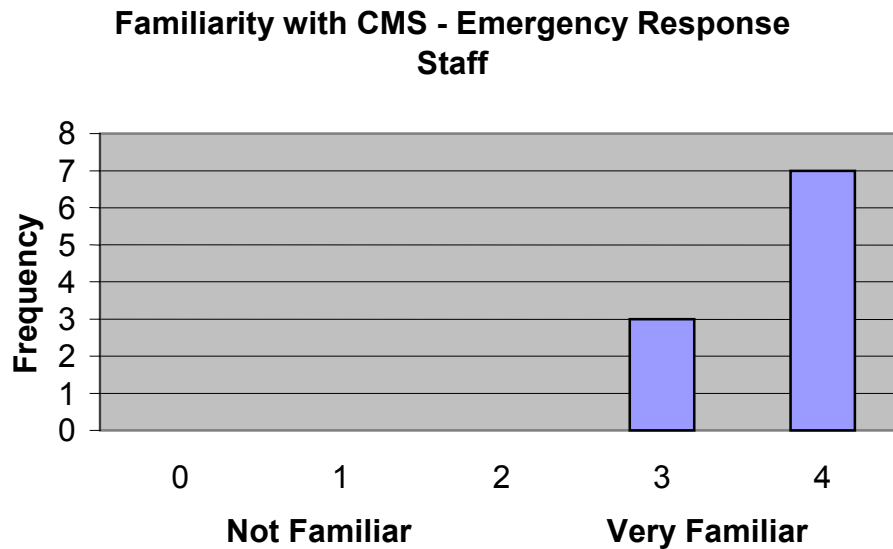
Figure 4.3-42 – Responses to Question 4
(How familiar are you with the Portable Changeable Message Signs?)

Work use descriptions for Portable CMS. The respondents were asked to describe how they worked with or were impacted by the use of the Portable Changeable Message Signs on I-90/94. The responses to this question (with number of identical or similar responses in parentheses) were:

- Advise motorists of crashes ahead and alternate routes (5)
- Coordinate incident response for District 5
- Changing the sign messages (not always convenient during incidents)
- Use signs for special events, detours, closures
- Activate signs from the District Communication Center

Perceived Impact of Portable CMS on Operations. The respondents were asked how they felt that the Portable Changeable message signs impacted their operations in the areas of a) Freeway Safety; b) Incident Response Time; c) Incident Clearance Time; and d) Travel Time. The possible responses for each item ranged from Worsened (0) to No Change (2) to Improved (4). Responses for each of these four items are summarized in Figures 4.3-43 to 4.3-46:
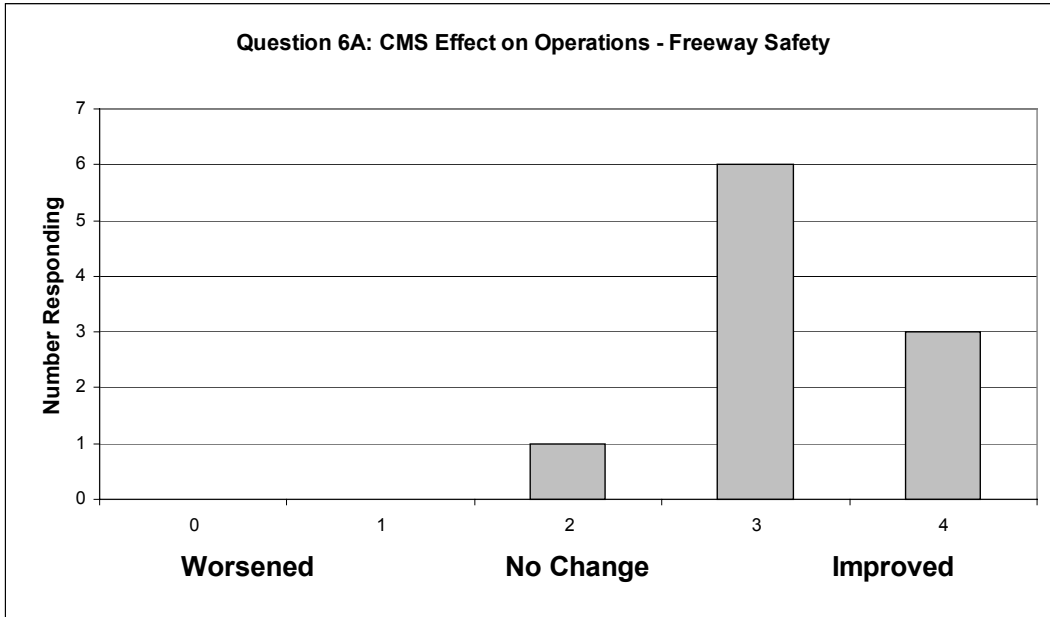
Figure 4.3-43 – Answers to Question 6A

(How much effect have the Portable CMS had in the area of: Freeway Safety?)
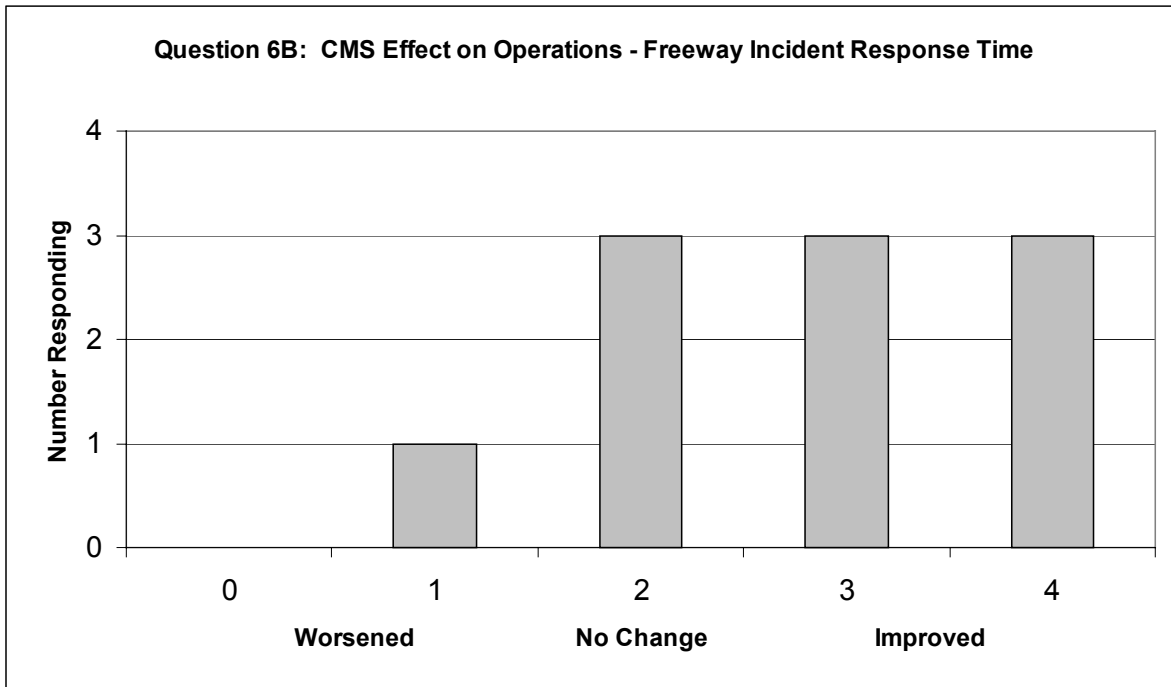
Figure 4.3-44 – Answers to Question 6B

(How much effect have the Portable CMS had in the area of : Incident Response Time)
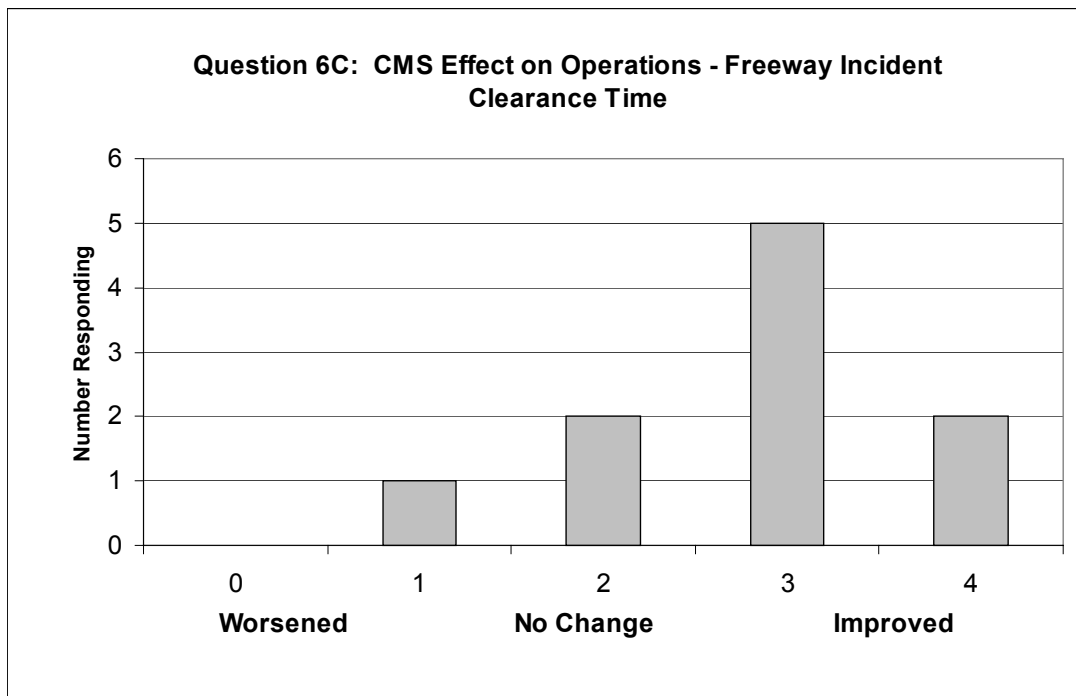
Figure 4.3-45 – Answers to Question 6C

(How much effect have the Portable CMS had in the area of : Incident Clearance Time)
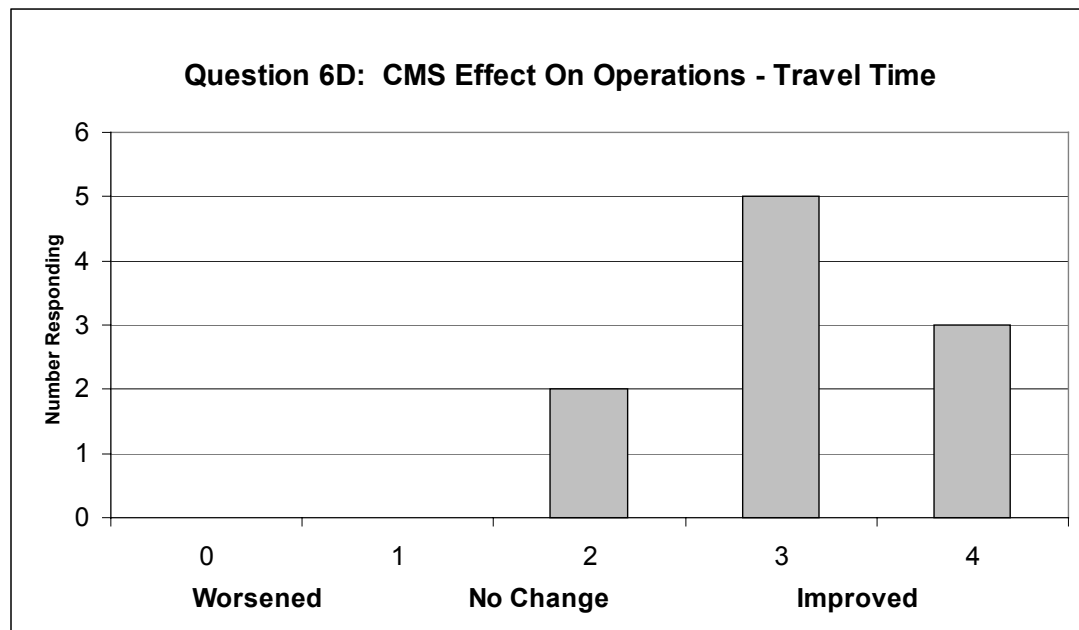
Figure 4.3-46 – Answers to Question 6D

(How much effect have the Portable CMS had in the area of : Travel Time)

Effectiveness of Portable CMS on Improving Conditions on I-90/94. The respondents were asked how effective they felt the portable Changeable Message Signs were on improving conditions on I-90/94, with answers ranging from Not Effective (0) to No Impact (2) to Very Effective (4). The results of the responses to this question are shown in Figure 4.3-47:

CMS Effectiveness - Emergency Response Staff
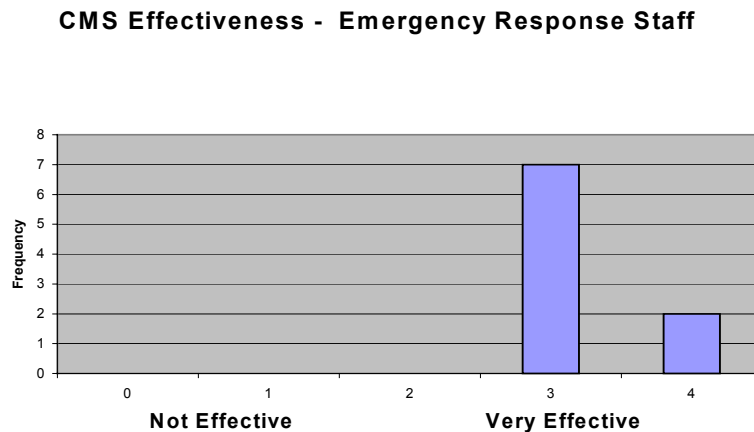
Figure 4.3-47 – Answers to Question 7

(How effective do you feel the Portable Changeable Message Signs have been in improving conditions on I-90/94)

Improvements Observed due to Portable CMS. The respondents were asked to describe specifically how the Portable Changeable Message Signs improved conditions on I-90/94. The responses to this question (with number of identical or similar responses in parentheses) were:

- The motorists are better prepared for the incident conditions ahead of the sign (5)
- Properly placed, signs warn motorists to merge sooner
- Helpful when the sign and its communication link work
- Less motorist confusion

Perceived Measures to Improve the Performance of Portable CMS. The respondents were asked what they thought could improve the performance of the portable changeable message signs. The responses to this question (with number of identical or similar responses in parentheses) were:

- Improve the reliability of cellular communications to the sign (5)
- Use more signs
- The CMS sign software should be more user-friendly
- The CMS sign software should have a feature that continuously shows the status of the units

Perceived Usefulness for Job Performance.   The respondents were asked how useful they felt the Portable Changeable Message Signs were in performing their jobs, with responses ranging from Not Helpful (0) to No change (2) to Very Helpful (4). The responses to this question are provided in Figure 4.3-48:

CMS Helpfulness for Job - Emergency Response Staff
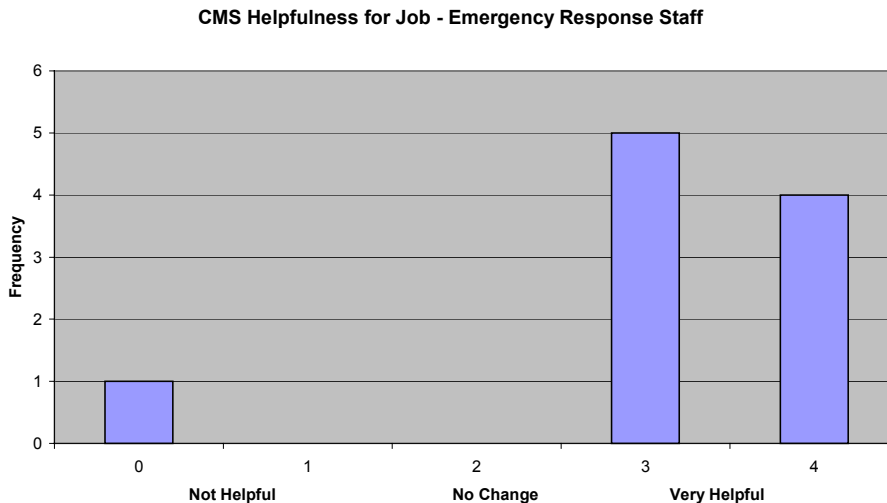
Figure 4.3-48 – Responses to Question 10
(How helpful do you feel the Portable Changeable Message Signs are to you in performing your job?)

Perceived ways that Portable CMS Helped Job Performance. The respondents were asked to specify how they felt the Portable Changeable Message Signs helped them perform their job. The responses to this question (with number of identical or similar responses in parentheses) were:

- Helped advise motorists to exit the Interstates during incidents
- Fewer phone calls from angry motorists (3)
- Can reduce the need for on-site personnel to change the message on the sign
- Reduces manpower needs (2)

Recommendations to make Portable CMS more Useful. The respondents were asked to state how they felt the Portable Changeable Message Signs could be made more useful to them. The responses to this question (with number of identical or similar responses in parentheses) were:

- Signs that have a more reliable communications link
- More installations at permanent locations
- More signs and locations
- Use only 1 version of the sign software instead of multiple versions
- More user-friendly software to make it easier to train field users of the signs
- Useful to have a dedicated resource person – Jeff Gustafson

Effectiveness in Responding to Incidents. The respondents were asked how effective they felt the portable Changeable Message Signs were at enhancing the response to incidents on I-90/94, with responses ranging from Not Effective (0) to No Change (2) to Very Effective (4). The responses to this question are provided in Figure 4.3-49:

Effectiveness During Emergency Response - Emergency Response Personnel
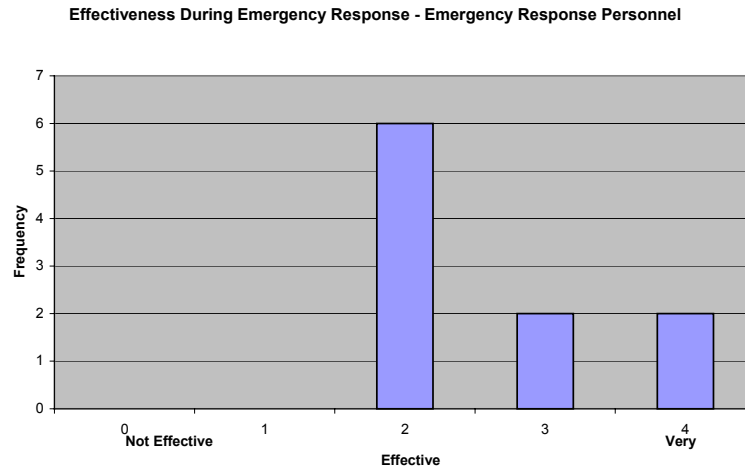
Figure 4.3-49 – Responses to Question 13

(How effective do you feel the Portable Changeable Message Signs are in enhancing the efficiency and timeliness for emergency personnel responding to incidents on I-90/94?)

Helpfulness of Additional Portable Changeable Message Signs. The respondents were asked how helpful they thought additional Portable Changeable Messages Signs would be on I-90/94, and if helpful, how could they best be used. Eight (8) people responded that additional signs would be more helpful. The responses to this question of how the signs could best be used (with number of identical or similar responses in parentheses) were:

- Have permanent locations with larger sign area for messages (2)
- Helpful to have more locations (5)
- Near expressway exits during seasonal events to warn motorists of backup

Reported Problems with Portable Changeable Message Signs. The respondents were asked to describe any difficulties they might have experienced with the use or operation of the Portable Changeable Message Signs. Nine of the ten people surveyed responded to this question. Their responses concerning problems with the portable changeable message signs (with number of identical or similar responses in parentheses) were:

- The communications link was not always reliable (6)
- Software problems, for example, attempting to cancel message causes lockup (2)
- Response time is a problem when private contractors use the signs
- It is difficult to reach WisDOT technical staff on weekends
- We can't always locate the signs in the best location to manage the wide range of incidents
- The organization of the messages is chaotic

Ease of Coordination. The respondents were asked how easy they felt it was to coordinate the operations and use of the Portable Changeable Message Signs with other agencies, with responses ranging from Very Difficult (0) to Very Easy (4). The responses to this question are provided in Figure 4.3-50:
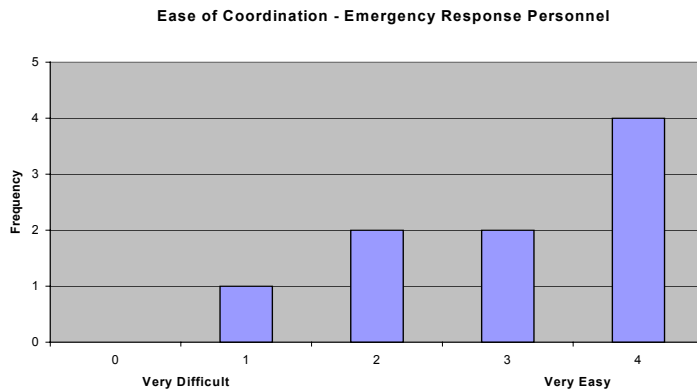
Figure 4.3-50 – Responses to Question 16

(How easy do you think it is to coordinate the operations and use of the Portable Changeable Message Signs with other agencies?)

Coordination problems. The respondents were asked to describe any problems they had in coordinating the use and operation of the Portable Changeable Message Signs. Four (4) of the ten people responding to the entire survey responded to this question. Their answers (with number of identical or similar responses in parentheses) were:

- WisDOT staff was helpful when assistance was needed (2, not really stating a coordination problem)
- There is limited technical support for sign operations
- Setup of Portable Changeable Message Sign and control station before the start of a project

Other Comments. The respondents were asked to provide any additional comments they had on the operation of the Portable Changeable Message Signs for the last survey question. Responses to this question were:

- Useful tool for State Patrol and motorists
- Good idea but needs improvements
- Too many rules for use put out by WisDOT
- The signs relieve driver stress
- The signs need software that is easier to use

4.3.3.1 Summary and Conclusions

The following Table 4.3-3 restates the objectives of the Portable Changeable Message Signs, and the measures of effectiveness proposed in the Earmark Evaluation Plan for use by State Patrol and other emergency response staff in responding to incidents on the I-90/94 corridor. An overall assessment of the survey results with respect to whether the objectives were achieved, is provided in the third column of Table 4.3-3.

Table 4.3-3 – CMS Objectives vs. Survey Results for Emergency Response Staff

Objective	MOE	Survey Summary Assessment
3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities	– User perception of the safety benefits of PCMS – Emergency personnel perception of the reduction in collisions, injuries and fatalities – WisDOT maintenance personnel perceptions of reduction in injury	– The majority of survey respondents felt that use of the PCMS signs improved freeway safety. – No specific reference was made in the survey responses to perceived reduction in collisions, injuries, and fatalities
3.2 Improve the average response time of emergency vehicles.	– Emergency response personnel perception of the reduction of response time	– The majority of survey respondents felt that use of the PCMS signs improved incident response time
3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents	– Emergency response personnel perception of reduction in response and clearance times	– The majority of survey respondents felt that use of the PCMS signs improved incident response and clearance times, and that the signs helped improve conditions on I-90/94 – Response was mixed on Question 13, however, where 60% of the respondents said the PCMS resulted in no change in their efficiency and timeliness in responding to and clearing incidents.

The following additional statements are judged to summarize the results of the surveys of WisDOT State Patrol and emergency response staff for the use of the Portable Changeable Message Signs:

- The predominant opinion of the Emergency Response users of the PCMS was that they are a useful tool to help with their job of managing incidents
- The PCMS would be more useful to State Patrol staff if they had a more reliable communication link, and if the software had a uniform interface that was more user-friendly
- Additional PCMS (with the referenced improvements) at more locations would be helpful for better response to incidents along I-90/94.
- The coordination and institutional issues for Wisconsin State Patrol staff operation of the Portable Changeable Message signs were minimal, however the surveys identified the following areas of concern:

  - One respondent said that response time is a problem when contractors use the signs. This was also an issue with WisDOT operating staff, and could perhaps be addressed with revising standard operating procedures, or developing a memorandum of understanding.
  - Respondents stated that staff to operate the signs was difficult to reach on weekends, or similarly, that technical support for the signs was difficult to obtain. These issues might be addressed by setting up a weekend, on-call duty roster for each District.
  - Another respondent mentioned that setup of the signs before the start of major projects (assumed for the purpose of providing local motorists of advance warning of traffic restrictions) could be better coordinated. Perhaps this item could be addressed by establishing a PCMS setup procedure as a checklist item at all major roadway project pre-construction meetings.

4.3.4 Institutional Issues Associated with Achieving Cooperation

WisDOT Staff PCMS Institutional Issues

The coordination and institutional issues for WisDOT staff operation of the Portable Changeable Message signs were minimal, however the surveys identified the following areas of concern:

- The availability of PCMS units for planned maintenance activities (for example, bridge repairs), versus the need to always have the units available for emergencies.
- The appropriate officials in the field need to call the PCMS operators when an incident is cleared, notifying to clear the message for the incident.
- The messages for incidents have to be timed to correspond to the actual arrival of the State Patrol and wrecker (tow truck) during response.

One respondent mentioned the issue of distinguishing a Contractor's PCMS units and their use, from WisDOT PCMS units. Perhaps this issue could be addressed with a standard memorandum of understanding (MOU) among WisDOT traffic management staff, Wisconsin State Patrol staff, and Contractors for major construction projects involving detours and lane reductions.

Wisconsin State Patrol PCMS Institutional Issues

The coordination and institutional issues for Wisconsin State Patrol operation of the Portable Changeable Message signs were minimal, however the surveys identified the following areas of concern:

- One respondent said that response time is a problem when contractors use the signs. This was also an issue with WisDOT operating staff, and could perhaps be addressed with revising standard operating procedures, or developing a memorandum of understanding.

- Respondents stated that staff to operate the signs was difficult to reach on weekends, or similarly, that technical support for the signs was difficult to obtain. These issues might be addressed by setting up a weekend, on-call duty roster for each District.

- Another respondent mentioned that setup of the signs before the start of major projects (assumed for the purpose of providing local motorists of advance warning of traffic restrictions) could be better coordinated. Perhaps this item could be addressed by establishing a PCMS setup procedure as a checklist item at all major roadway project pre-construction meetings.

4.3.5 Lessons Learned on Issues Encountered in Integrating ITS Components

Since the Portable Changeable Message Signs purchased were operated primarily as independent systems, the issues encountered in integrating them with other ITS components were minimal, however the surveys identified the following areas of concern:

- Lack of reliability of the remote connection – this concern was raised by a large number of both emergency response and WisDOT staff. Due to a lack of cellular communication infrastructure in some areas, it often difficult to connect remotely with the PCMS.

- Problems with the PCMS software including:
  - Lack of reliability – one respondent commented that improving the reliability of the software would reduce the need for on-site confirmation of messages.

- Difficult to use –both emergency response and WisDOT staff commented that improvements to the software to make it more "user friendly" were needed. Since PCMS purchased at different times and from different vendors each have their own software, users must become familiar with many different interfaces. A single common user-friendly interface could increase efficiency and reduce the training requirements.

4.4 Permanent Highway Advisory Radio for the Hudson "Port-of-Entry"

This project involves the purchase of one permanent highway advisory radio (HAR), along with two alert signs and associated yellow flashers. The HAR was installed along Interstate 94 at the "port-of-entry" in Hudson, Wisconsin. The alert signs with yellow flashers were installed to serve traffic in both directions. One sign was installed for westbound traffic near mile point 5.5 on I-94 in Hudson, WI. The second sign was installed for eastbound traffic near mile point 253 on I-94 in Minnesota.

The Wisconsin State Patrol has the primary responsibility to activate and add messages to the HAR, although information can be provided to the State Patrol by other divisions within the Wisconsin Department of Transportation (WisDOT), other law enforcement agencies, and other sources. The signs will generally be activated to warn motorists of dangerous conditions, traffic delays, detours, and maintenance or construction activities. The objectives of installing the permanent HAR included:

- Improve the accessibility and availability of travel information to travelers in the corridor
- Reduce time delay by warning drivers of congestion and offering alternate routes
- Improve the safety of motorists, construction crews, law enforcement, and emergency responders by warning drivers of dangerous conditions

The results of two tests conducted for the evaluation of the permanent highway advisory radio are discussed in the following sections:

- Survey of Wisconsin State Patrol PCOs (Section 4.4.1)
- Web-based User Survey (Section 4.4.2)

4.4.1 Survey of Wisconsin State Patrol PCOs

The Wisconsin State Patrol is the agency primarily responsible for activating and broadcasting messages on the HAR system. Surveys were sent to Police Communications Operators (PCOs)to get their feedback on the use and perceived benefits of the HAR. Eight surveys were returned, although one respondent had never used the system and thus could not answer any of the questions.

Initial Operational Problems. The operators were asked if there were any initial operational problems with the HAR system, and how long it took to resolve those problems. The responses to this question (with number of identical or similar responses in parentheses) were:

- Lightning struck Wisconsin side of system and flashing lights would not work. Took about a month to fix. (3)
- HAR transmitter wouldn't take messages. Was fixed by changing baud rate on modem.

Frequency of HAR Broadcasts. The operators were asked how often they need to broadcast messages on the HAR system, noting if there were any differences due to the time of year. The responses to this question (with number of identical or similar responses in parentheses) were:

- Couple of times, mainly during winter snowstorms
- Very rarely, maybe half-a-dozen times since install
- Crashes or other incidents involving closing all or parts of interstate (2)
- Whenever crashes occur that it might assist in traffic management at/near the coverage location
- In the last year, I have personally only used the HAR once.

Sources of Information. The respondents were asked to choose where they typically get their information. The choices included State Patrol troopers, WisDOT staff, local law enforcement, drivers, media, or other. The responses are shown in Figure 4.4-1
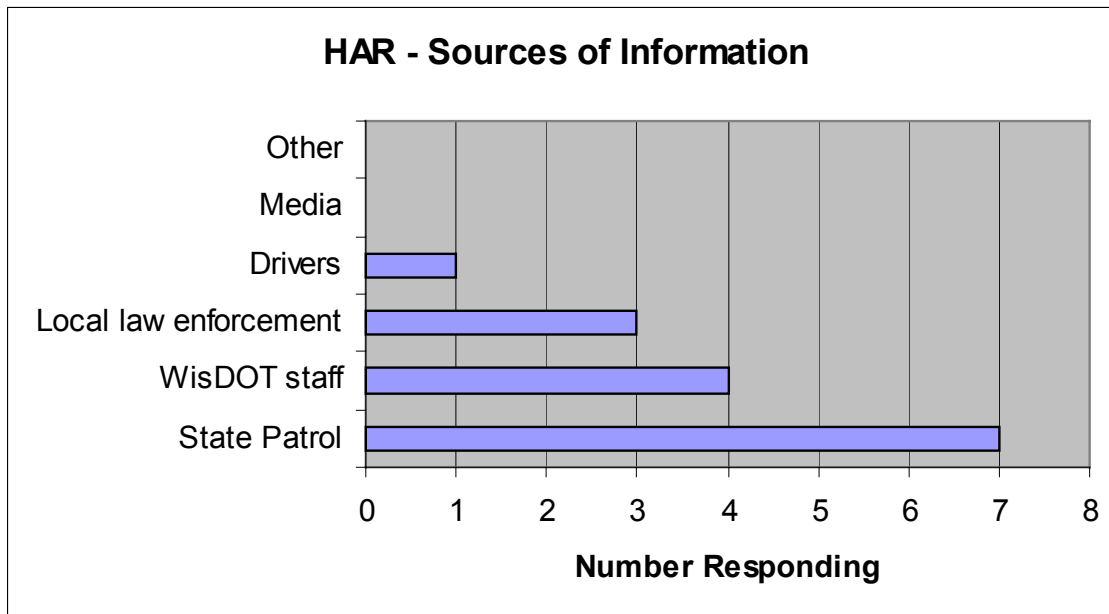
Figure 4.4-1 – Sources of Information for HAR

Activation of HAR. The operators were asked to describe the method used to activate the HAR system and enter a message for broadcast, and if the system was easy to use. The responses to this question (with number of identical or similar responses in parentheses) were:

- Sign on; go to Program Schedule; select message to be played and drag into a numbered slot under message name; repeat until whole series is done; listen to message play prior to sending to HAR station; turn on either MN or WI flashing lights; go to update screen and hit update button; call station to verify. It's fairly easy. (2)
- Have not had opportunity to use it.
- Computer for the messages on the radio and phone for activating the flashing lights.
- Computerized system. It is fairly easy to use. Depends on how fast the computer accesses the HAR system. Seems to take a while sometimes. (2)

Improvements or Additional Features. The PCOs were then asked if there were any improvements or additional features they would like to see added to the activation and data entry systems. The responses to this question (with number of identical or similar responses in parentheses) were:

- It must send the messages quicker. Takes 20 minutes to send three sentences of message. (3)
- Easier access to more messages we can utilize.
- In my opinion, it would be easier to just record a message and send it to HAR station than looking through a library and having to find something.

Types of Information Broadcast Over HAR. The operators were asked to choose the types of information that are usually broadcast on the system. The choices included incident locations, location and duration of severe congestion, road closures, detour routes, weather conditions, road and pavement conditions, travel times, and other. The responses are illustrated in Figure 4.4-2.
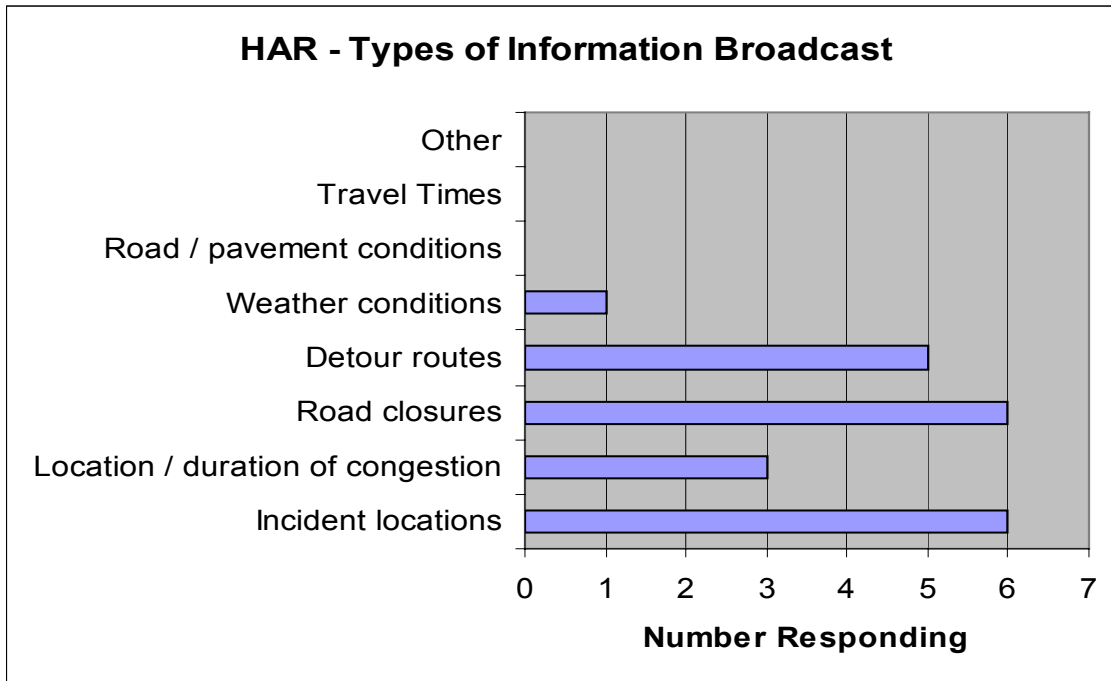
Figure 4.4-2 – Information Broadcast on HAR

Improvements Due to HAR. The next question asked operators to list their perception of improvements in different categories due to the installation and use of the HAR system. The choices were none, slight, moderate, or significant. The categories included reduction in vehicle delay, reduction in primary accidents, reduction in secondary accidents, reduction in incident response time, reduction in incident response time, increase in safety for emergency crews, and reduction in traveler inquiries. The results are shown in Figures 4.4-3 through 4.4-9.
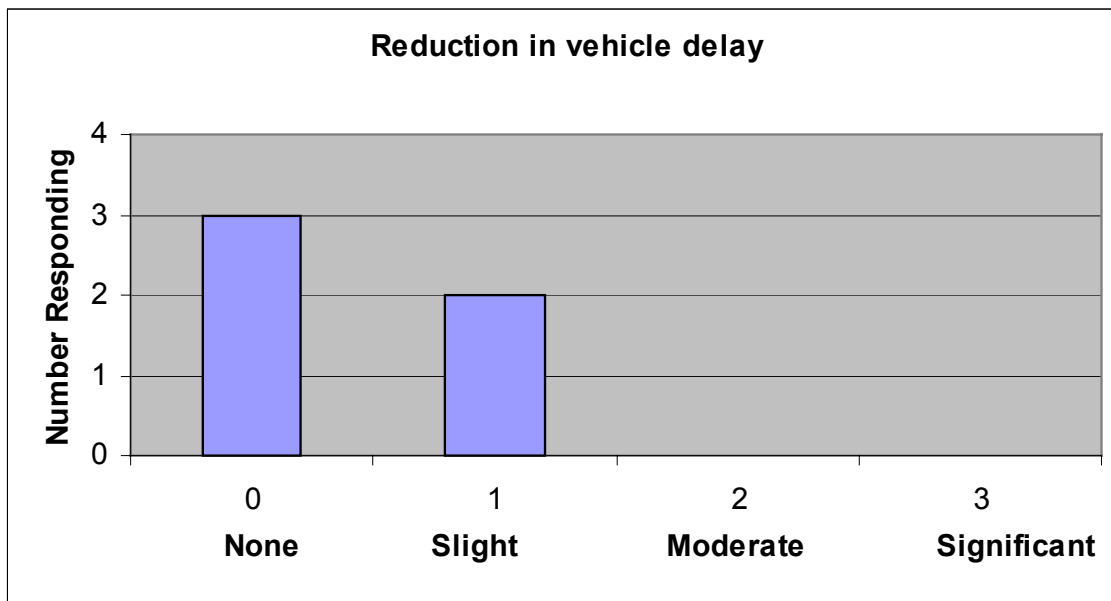
Figure 4.4-3 – Reduction in Vehicle Delay
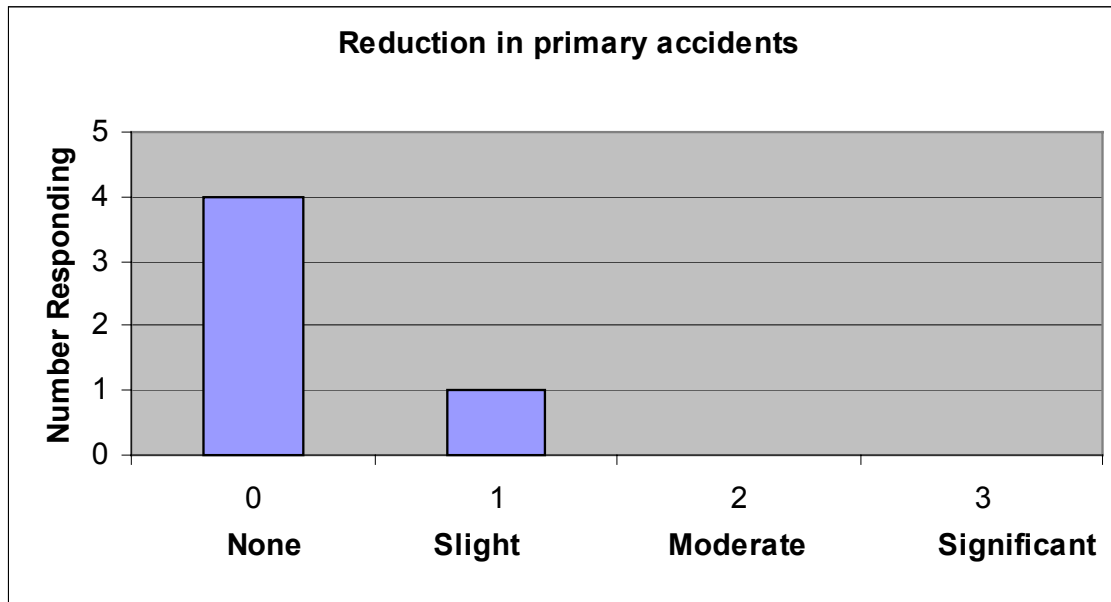
Figure 4.4-4 – Reduction in Primary Accidents
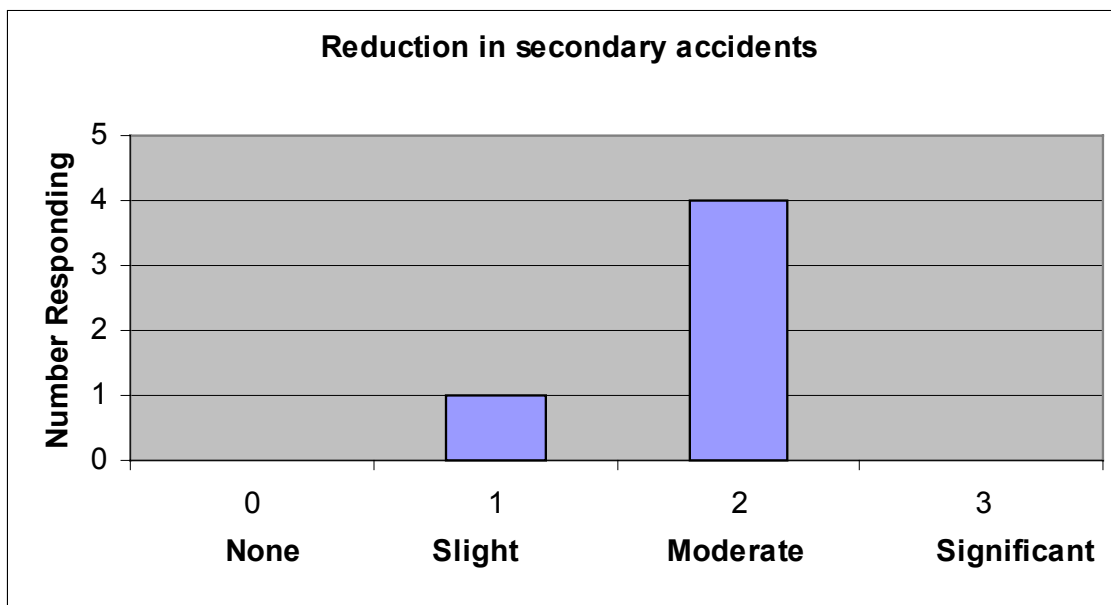
Figure 4.4-5 – Reduction in Secondary Accidents

Figure 4.4-6 - Reduction in Incident Response Time
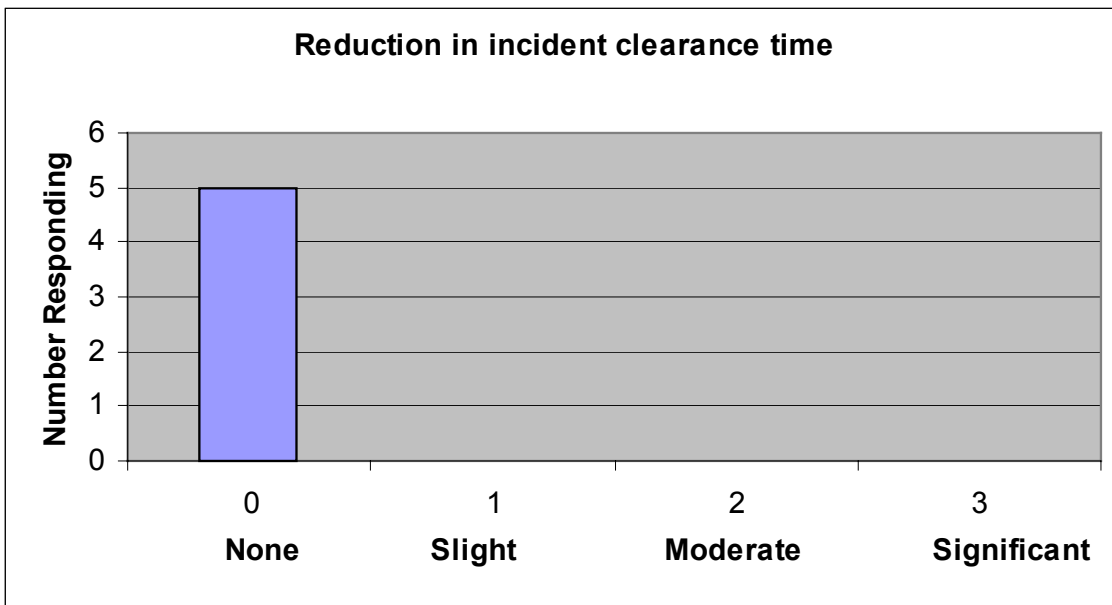
Figure 4.4-7 – Reduction in Incident Clearance Time
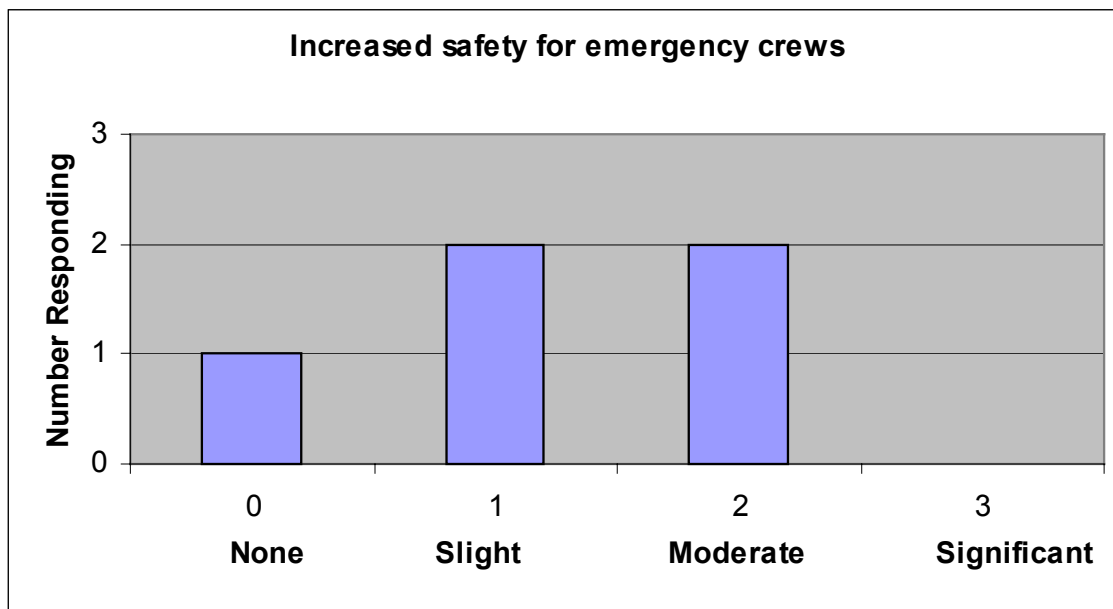
Figure 4.4-8 – Increased Safety for Emergency Crews
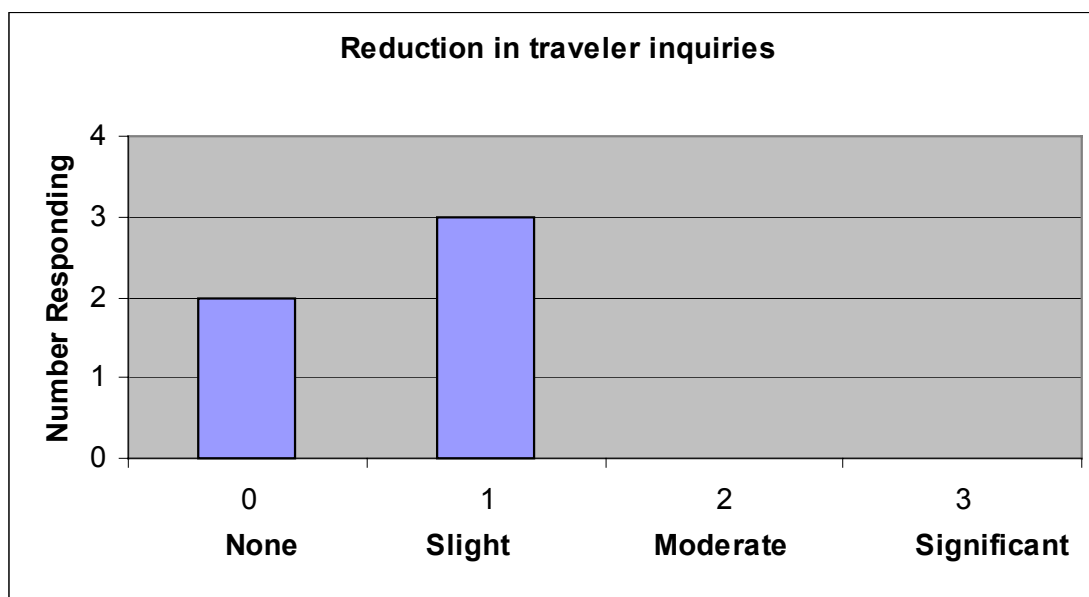
Figure 4.4-9 – Reduction in Traveler Inquiries

Additional Uses of Information. The operators were asked if there were any other potential uses for the HAR system, or other types of information they would like to see broadcast. The responses to this question (with number of identical or similar responses in parentheses) were:

- Amber Alert (2)
- None (3)

Overall Benefit of HAR. The operators were asked, in their view, how effective the HAR system has been in improving the safety and efficiency of the targeted highway network. The choices were no improvement, slight improvements, moderate improvement, or significant improvement. The results are shown in Figure 4.4-10.

Overall Improvement Due to HAR

| | 0 None | 1 Slight | 2 Moderate | 3 Significant |
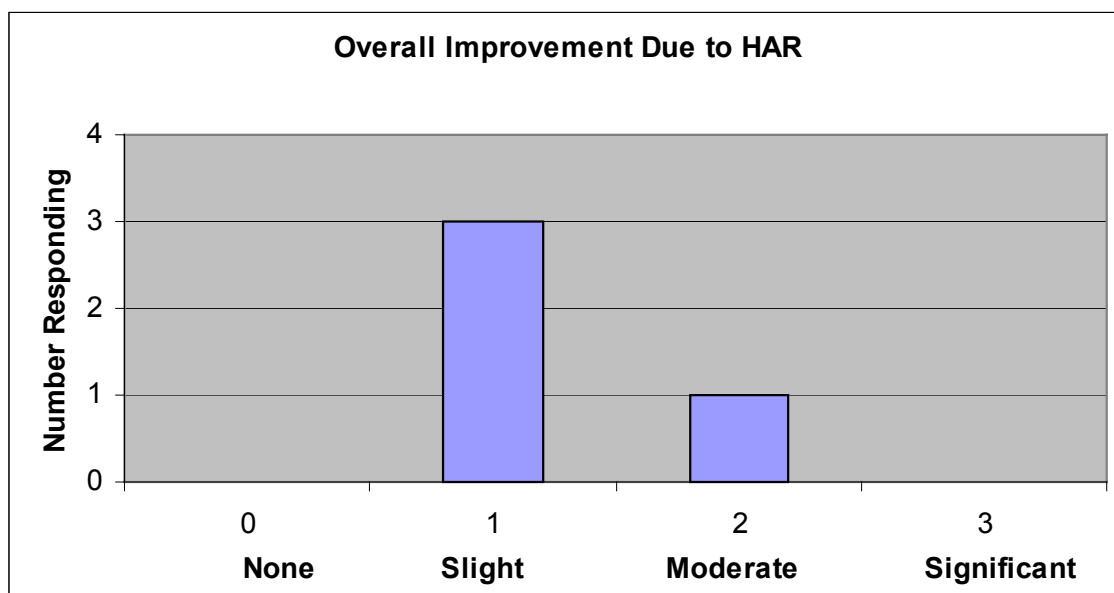
Figure 4.4-10 – Overall Improvement Due to HAR

4.4.2   Web-based User Survey

A web-based user survey (found at http://www.hudson530.com) was created to get feedback from motorists who may have listened to at least one HAR broadcast message. The survey featured a series of questions designed to get feedback about the types of information motorists heard on the HAR broadcast, what decisions they made based on the information, and their preferences for the types of information they would like to get, and their satisfaction with the HAR system. Most of the questions were either multiple-choice or check-box questions, but there was also a free response comments section at the end of the survey.

In August 2003, the Wisconsin State Patrol started broadcasting a message asking motorists to visit the hudson530 website to fill out the survey. This message was appended to the end of the regular traveler information message, and was only supposed to be broadcast when there was also important traveler information, and the HAR system was activated. There was an instance in December 2003 when the message to visit the website was broadcast without any additional traveler information. The State Patrol was notified of this occurrence, and some of the comments from the surveys reflect the frustration of drivers who tuned in to the broadcast, and did not get the expected traveler information.

The first survey responses arrived in late August 2003. Over the next four-and-a-half months, until January 2, 2004, there were a total of 67 people who responded to the survey. The results are summarized in the following sections. Also, a complete list of free response user comments is attached in Appendix C of this report.

Method of Receiving Information about the Survey. Respondents were asked how they were directed to the web site to answer the survey. The responses are shown below in Figure 4.4-11:
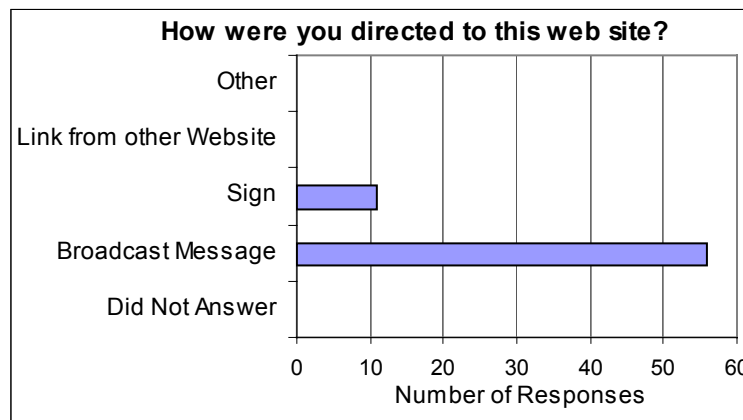
Figure 4.4-11 – Method of Receiving Information About Survey

Characteristics of the Respondents. Respondents were asked to provide information about their gender and age. The responses are shown in Figures 4.4-12 and 4.4-13.
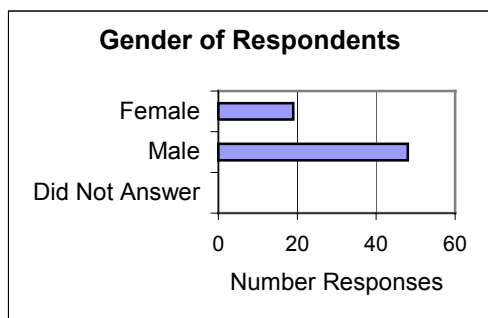
Figure 4.4-12 – Gender of Respondents
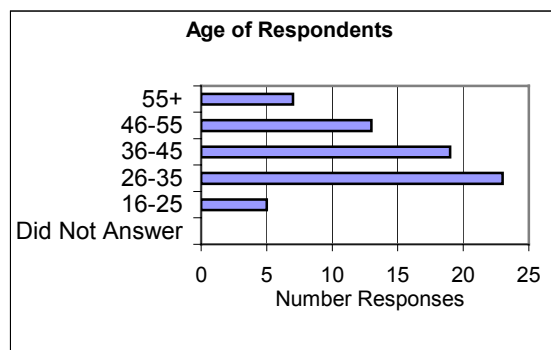
Figure 4.4-13 – Age of Respondents

Familiarity with the HAR Alert Signs. Respondents were asked whether they had ever seen the HAR alert signs flashing. However it should be noted that the response to this question, may not be representative of drivers as a whole since the majority of the respondents were made aware of the survey from the message appended at the end of the HAR broadcast. The responses are shown in Figure 4.4-14.
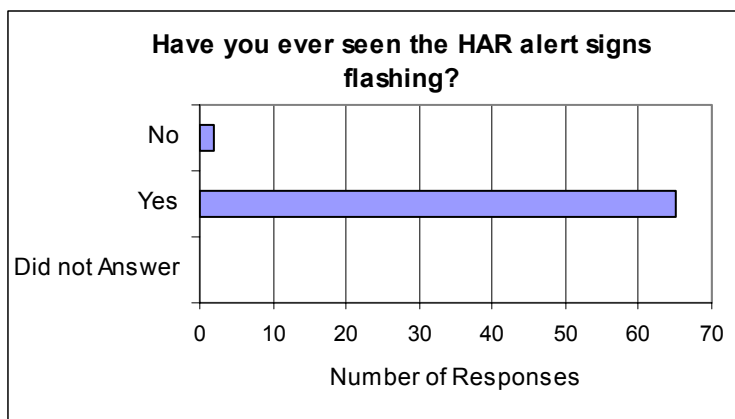
Figure 4.4-14 – Familiarity with the HAR Alert Signs

Legibility and Clarity of Alert Sign Instructions. Respondents were asked whether the instructions on the alert signs were legible and clear. The responses are shown in Figure 4.4-15.

Are the instructions on the alert signs legible and clear?

	Number of Responses
No	
Yes	
Did Not Answer	
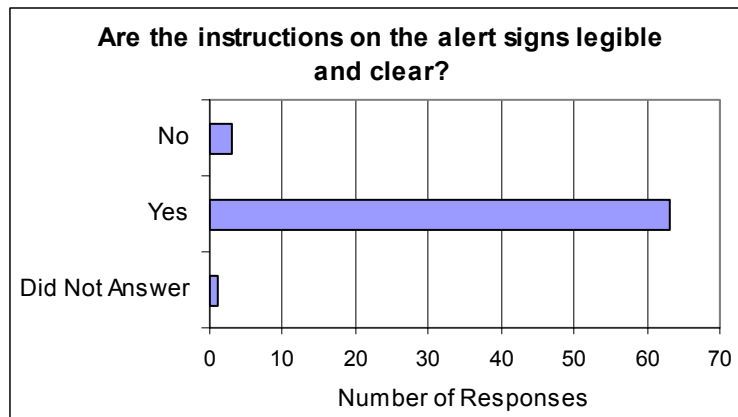
Figure 4.4-15 – Legibility and Clarity of Alert Sign Instructions

Reliability of the Alert Signs. Respondents were asked whether they had ever noticed an instance where the alert sign was flashing, yet there was no message being broadcast. The responses are illustrated in Figure 4.4-16.

Have you ever noticed a sign flashing when there was no message being broadcast?

	Number of Responses
No	
Yes	
Did Not Answer	
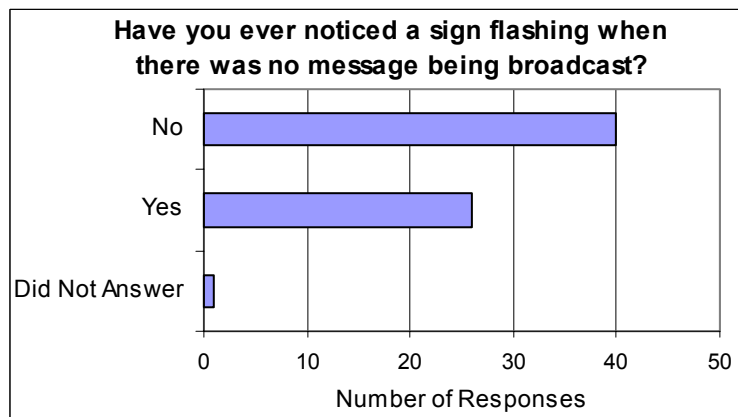
Figure 4.4-16 – Reliability of Alert Signs

Frequency of Use of HAR. Respondents were asked how often they listen to messages broadcast on the HAR. The responses are illustrated in Figure 4.4-17.
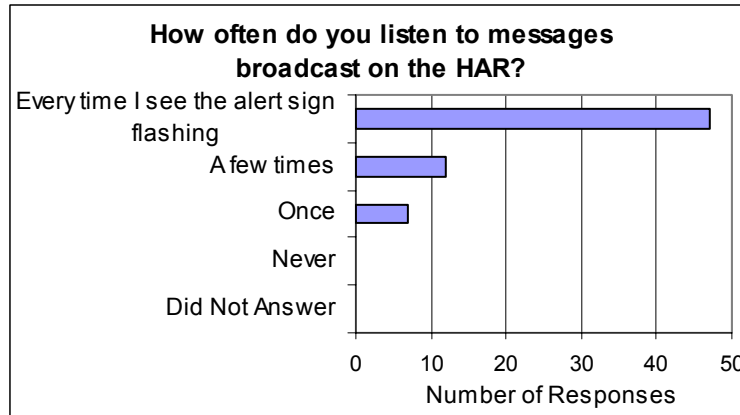
Figure 4.4-17 – Frequency of Use of HAR

Clarity of Messages. Respondents were asked whether the messages have been clear and easy to understand. If they answered no, they were asked to select a reason why they had difficulty understanding the messages. The responses are shown in Figure 4.4-18 and Figure 4.4-19.
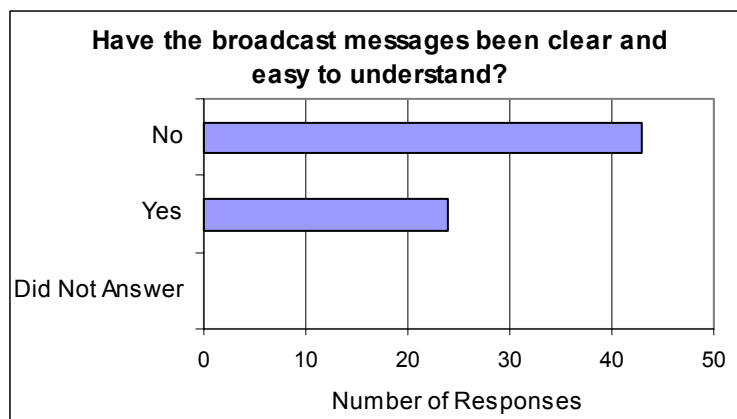
Figure 4.4-18 – Clarity of Messages
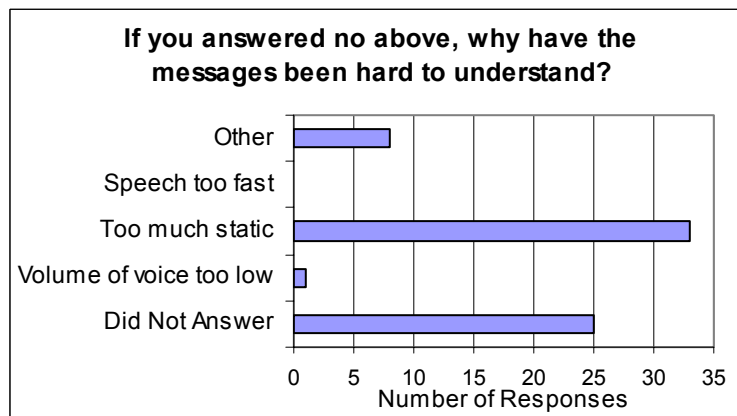
Figure 4.4-19 – Reason that Messages were Hard to Understand

Helpfulness of the Messages. Respondents were asked to describe in general how helpful they felt the messages have been to them. The responses are shown in Figure 4.4-20.

In general, how helpful do you feel the messages have been?
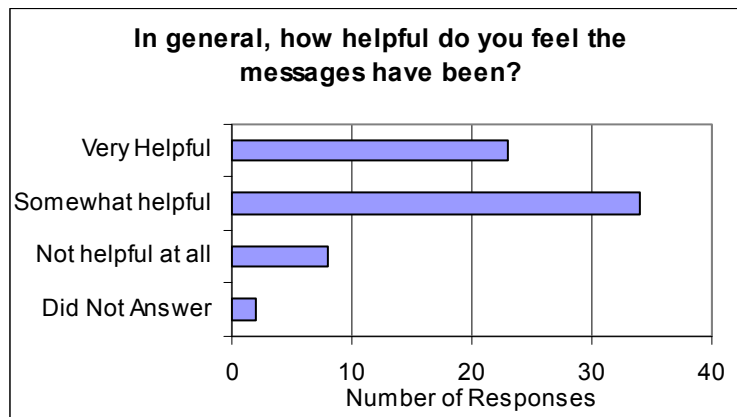
Figure 4.4-20 – Helpfulness of Messages

Information Provided. Respondents were asked to select the types of information that the messages have provided. For this question respondents could select all the answers that applied. The responses are shown in Figure 4.4-21.

What types of information have the messages given? (check all that apply)
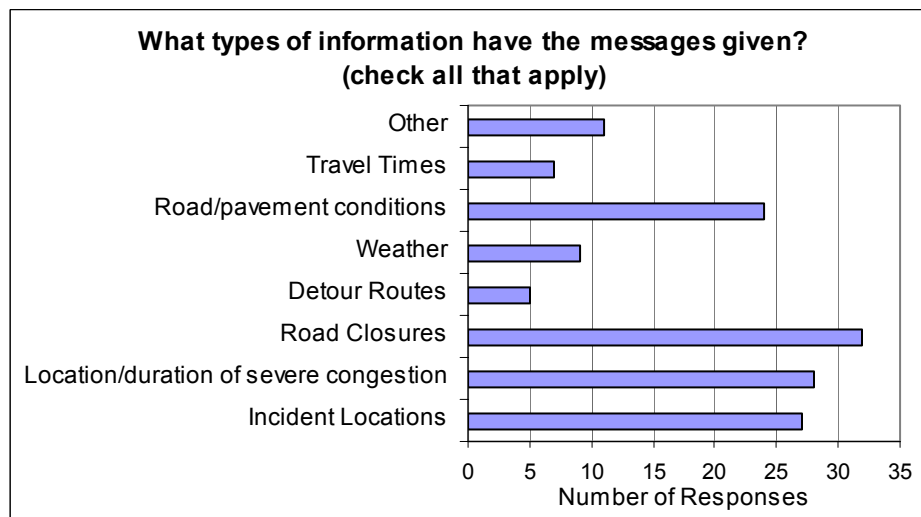
Figure 4.4-21 – Information Provided by Messages

Perceptions of Level of Detail of Messages. Respondents were asked whether, in general, the information provided has been too specific, too general, or at an appropriate level of detail. The responses are illustrated in Figure 4.4-22
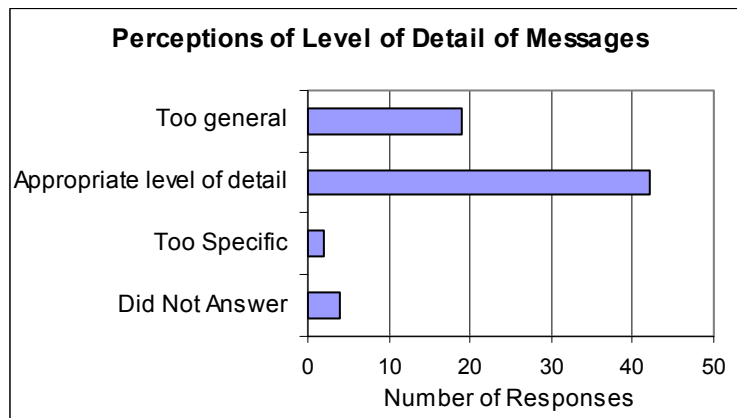
Figure 4.4-22 – Perceptions of Level of Detail of Messages

Timeliness of Information. Respondents were asked to describe in general how timely the information was that was provided. If they answered that the information was not timely they were then asked to select a reason why. The responses are shown in Figure 4.4-23 and Figure 4.4-24.
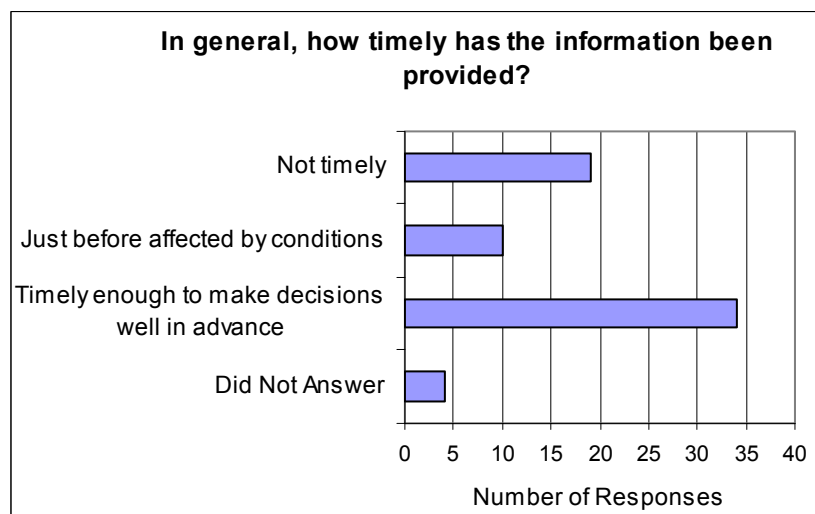
Figure 4.4-23 – Timeliness of Information
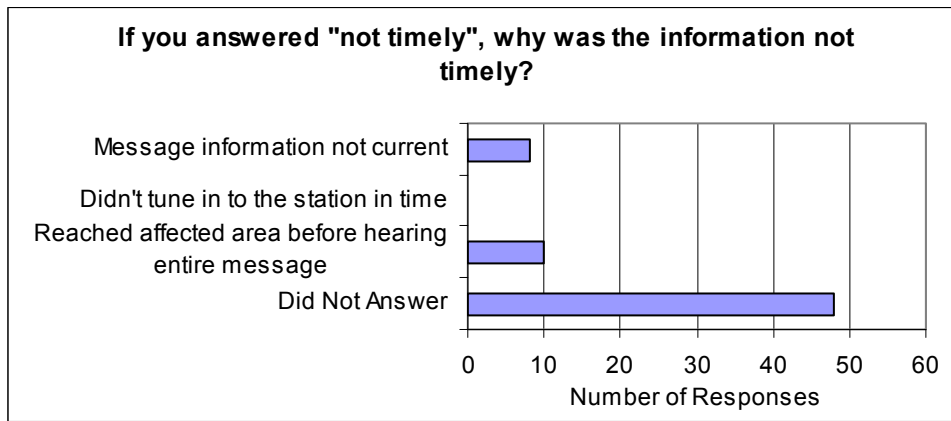
Figure 4.4-24 – Reasons for Untimely Information

Usefulness of the Information for Route Selection. Respondents were asked whether overall the provided information helped them to make an informed decision regarding their travel route. The responses are illustrated in Figure 4.4-25.
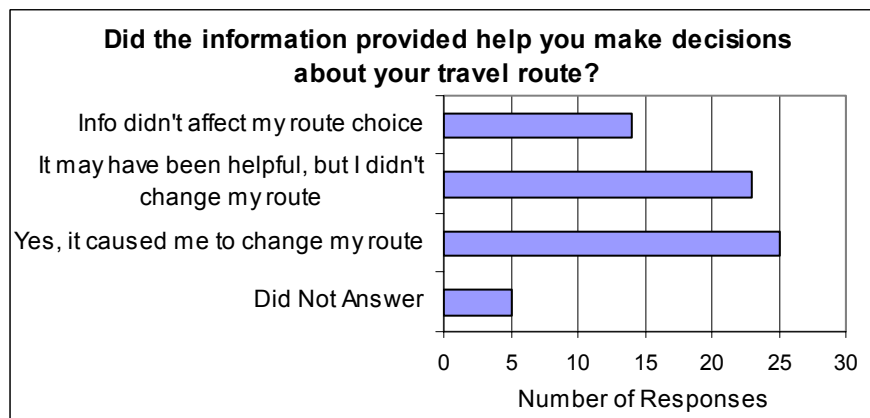
Figure 4.4-25 – Usefulness of Information for Route Selection

Information Provided about Alternate Routes. If they answered that they took an alternate route, respondents were asked what was available to guide them along their route. For this question, respondents were asked to select all answers that applied. The responses are shown in Figure 4.4-26.

If you took an alternate route, were any of the following available to guide you?
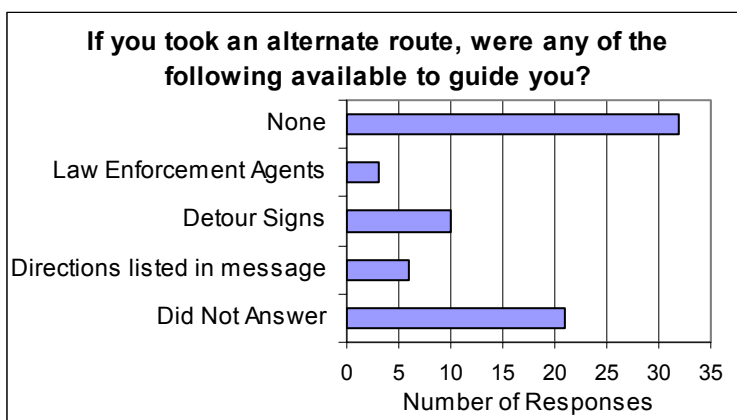
Figure 4.4-26 – Information Provided about Alternate Routes

Alternate Route Selection. If they answered that they took an alternate route, respondents were asked to describe why they selected the route they did. The responses are shown in Figure 4.4-27.

If you took an alternate route, why did you choose that route?
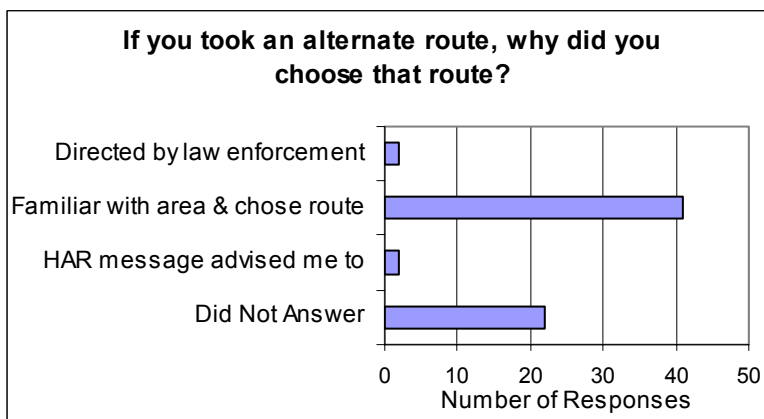
Figure 4.4-27 – Alternate Route Selection

Travel Time Saved from Alternate Route Selection. Respondents were asked in general if they took an alternate route by choice, whether they felt they saved travel time compared to if they had stayed on the main route and traveled through the affected area. The responses are illustrated in Figure 4.4-28.

If you took an alternate route by choice do you think you saved time?

Response	Number of Responses
Yes, I think I saved a lot of time	21
Yes, I may have saved a minute or two	16
No, it would have been the same either way	4
No, the alternative route took longer	5
Did Not Answer	21
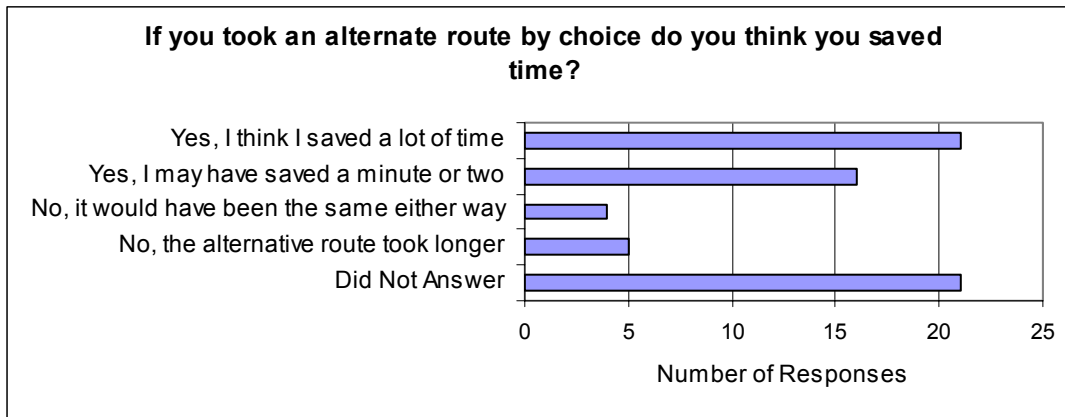
Figure 4.4-28 – Travel Time Saved from Alternate Route Selection

Comparison of the Usefulness of HAR with Variable Message Signs. Respondents were asked first whether they were familiar with Variable Message Signs. They were then asked to choose whether they would rather get information via a variable message sign or highway advisory radio for a variety of different types of information. The responses are illustrated in Figures 4.4-29 and 4.4-30.

Are you familiar with VMS?

Response	Number of Responses
Not Sure	0
No, I have not seen them	2
Yes, I have seen them	64
Did Not Answer	1
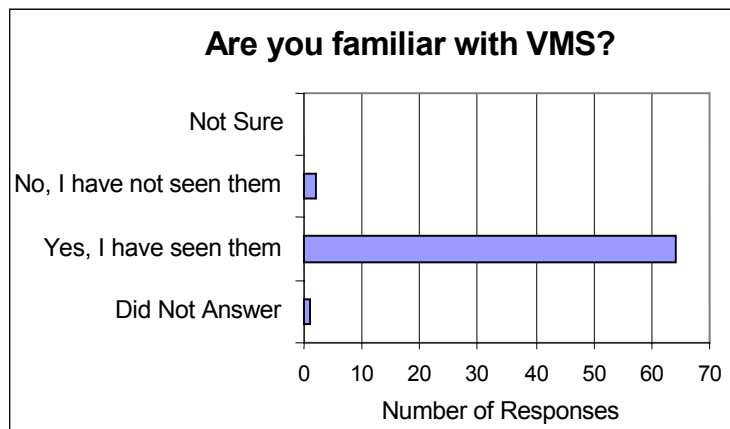
Figure 4.4-29 – Familiarity with Variable Message Signs
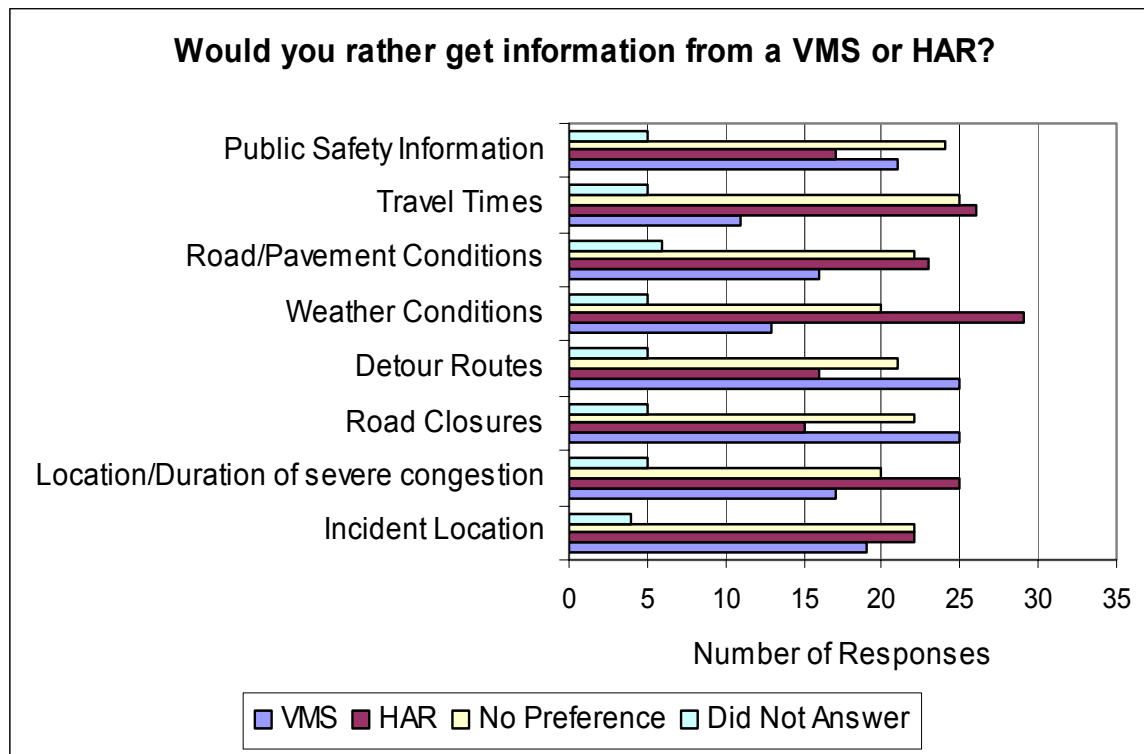
Figure 4.4-30 – Preference for HAR or VMS

4.4.3 Summary and Conclusions

The following Table 4.4-1 restates the objectives of the Permanent Highway Advisory Radio, and the measures of effectiveness proposed in the Earmark Evaluation Plan for use by State Patrol in responding to incidents on the I-94 corridor. An overall assessment of the results of the surveys of State Patrol Public Communications Operators and users, with respect to whether the objectives were achieved, is provided in the third column of Table 4.4-1.

Table 4.4-1 –HAR Objectives vs. State Patrol Survey Results

Objective	MOE	Survey Summary Assessment
1.1 Improve the accessibility and availability of travel information to tourist, commercial vehicle operators and other users of all transportation facilities.	Coverage area, Improvement in customer satisfaction	- Motorists in the I-94 corridor in St. Croix County, WI and far eastern Minnesota can get important traveler information. - 70% of respondents to the user survey indicated that they listen to the HAR messages every time they see the alert sign flashing. - The great majority of User Survey respondents felt that the messages were helpful. 52% felt they were somewhat helpful and 35% said they were very helpful.
2.1 Reduce travel delay and increase the reliability and predictability of moving people and goods for all transportation users.	User perception of reduction in travel time and delay	- The majority of user survey respondents who took an alternate route based on the information provided by HAR felt they saved travel time. 46% felt it saved them a lot of time while 35% felt it saved them a minute or two.
2.2 Improve the ability of tourists, commercial vehicle operators and other users to perform travel planning using timely travel information.	Timeliness of information	- 37% of user survey respondents indicated that the information provided on HAR caused them to change their route. 40% responded that they information was helpful but did not cause them to change their route. - The majority of user survey respondents felt that the information provided was timely enough to make decisions well in advance of the affected area (54%) or just before the affected conditions (16%).
2.3 Reduce the operation costs to operators incurred from inefficient transportation facilities.	Operating costs	- The majority of respondents who took an alternate route based on the information provided by HAR felt they saved travel time.

3.1 Reduce the number of motor vehicle collisions, associated injuries and fatalities.	Reduction in accidents, injuries, and fatalities	- The State Patrol indicated that while they believe the HAR doesn't have much of an impact on primary accidents, they do perceive a moderate reduction in secondary accidents, and an overall increase in safety.
3.3 Improve the ability to identify, respond and/or mitigate the effects of incidents.	User perception of reduction in travel time and delay	- The State Patrol does not perceive much of a benefit in improved response time. They perceive no or a slight improvement in travel time and vehicle delay.
4.1 Reduce time delay and costs associated with congestion	User perception of reduction in travel time, delay, and operating costs	- State Patrol perceives no or a slight improvement in travel time and vehicle delay. - The majority of user survey respondents who took an alternate route based on the information provided by HAR felt they saved a considerable amount of travel time.
4.2 Optimize operational efficiency of goods and people movement on existing facilities.	User perception of reduction in travel time, delay, and operating costs	- State Patrol perceives no or a slight improvement in travel time and vehicle delay.
5.1 Establish intercity corridors that advance the National ITS Program and advance the deployment and integration technology.	Coverage area	- Coverage in St. Croix County, WI and far eastern Minnesota along I-94

Based on the responses to the survey questions and the comments, the following are the main issues of concern:

- Lack of Reliability - 39% of respondents indicated that they had noticed a HAR alert sign flashing when there was not message being broadcast. There were also several comments from the respondents about this problem including:
    - "The lights should only flash when there is a message about the road/traffic conditions."
    - "I believe this service is underused."
- Poor Reception - 64% of the respondents answered that the messages were not clear and easy to understand. When asked why this was, 78% indicated that there was too much static. There were also a number of comments from the respondents that described problems with the reception including:
    - "Low volume"
    - "Signal is too weak to be effective" and "The station barely comes in."
- Lack of coverage of the area –
    - "The highway advisory radios are good but the one by Hudson does not broadcast far enough. You can only pick it up when you pass Carmichael Road (traveling west and by then it is too late. The traffic is backed up two miles beyond that point."
    - "I hope the radio is used for alerts other than right around Hudson. I would hope it would also alert of problems towards the Cities or towards Menomonie."
- Location of Alert Signs:
    - The flashing lights and highway sign on Hwy 94 just east of Hudson is in the wrong location. If there is a problem either along 94 in Hudson or on the bridge, during rush hour the traffic backs up at least 7 miles to the Roberts exit."

4.4.4 Institutional Issues Associated with Achieving Cooperation

There were no significant issues related to achieving cooperation between agencies indicated from the survey of Wisconsin State Patrol Police Communications Operators. The respondents were asked if to describe any difficulties, or specific "success stories", in coordination between different agencies for this project. All of the respondents indicated that either they were not involved in any coordination, or didn't know of any specific problems or "success stories" with the coordination.

4.4.5 Lessons Learned on Issues Encountered in Integrating ITS Components

Since the HAR at the Hudson "Port-of-Entry" was operated as an independent system, there were no significant issues encountered in integrating it with other ITS components.

APPENDIX A

Laptop Computer Purchase – Agency User Sample Survey Form

> Wisconsin Department of Transportation
> I-90/94 Federal Funding Evaluation Study
> Initiative 1: Purchase of Laptop Computers

To Users of Laptop Computers:

The Wisconsin Department of Transportation (WisDOT) benefited from Federal funding to purchase Laptop Computers for WisDOT District 6 and its associated County Highway Departments.   Highway maintenance and operations staff used the computers to improve access to weather information and make more informed decisions.   WisDOT is conducting an evaluation to determine how well this project performed at meeting the goals set by the Federal Highway Administration (FHWA), including more efficient and timely response to weather events within the I-90/94 corridor.

Your help is needed to fulfill the obligations of the Federal funding and insure that WisDOT will be eligible for future Federal funding.   The following survey has been developed to obtain feedback from operators who have used the Laptop Computers. We are requesting that you take the time to answer the survey questions, and include brief comments on your experience in the spaces provided.

In order for the required study to be completed according to a planned schedule, we request that the survey be completed within one week, and returned to your district coordinator.
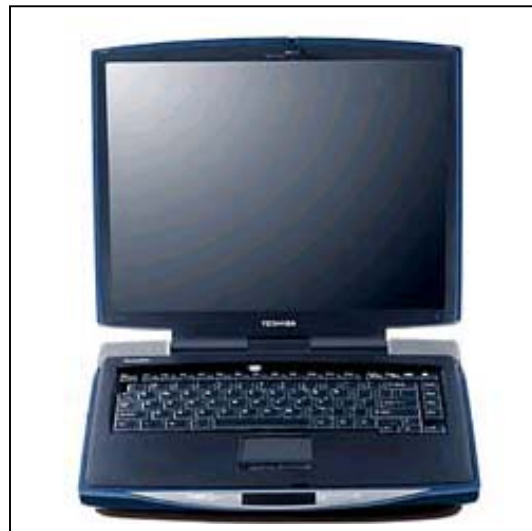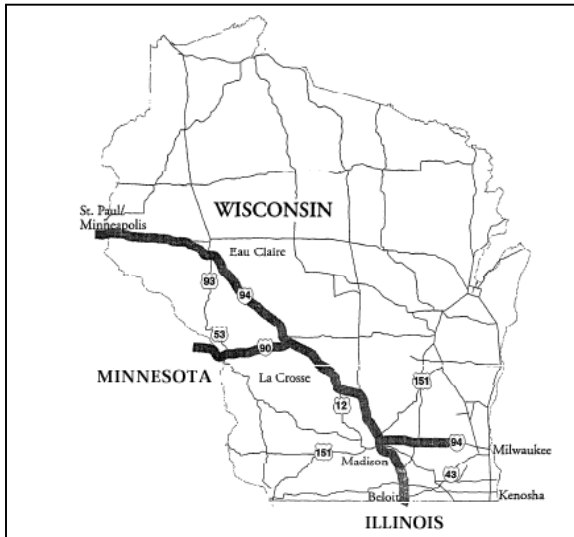
I-90/94 Earmark Evaluation
Laptop Computers

SURVEY QUESTIONS - County Highway Department Patrol Superintendents

1.   Please provide your title or position in the area of highway operations _____

2.   If you have used one of the laptop computers in District 6, check the location(s) of use in the appropriate area(s):

District 6 County: Eau Claire___   Dunn___   St. Croix___   Pierce___
                                Chippewa___   Pepin___   Taylor___   Clark___

3.   Before the purchase of the laptop, how did your agency obtain weather information?

4.   Has the laptop made it easier to access weather information? How so?

5.   Where do you use the laptop to access weather information (check all that apply)? Please estimate the number of hours per week in the winter storm season that you use the laptop in each location.
   a.   ___ Work   _____ hours/week
   b.   ___ Home   _____ hours/week
   c.   ___ Mobile patrol   _____ hours/week

6.   How much of an effect has the use of the laptop had to help your department reduce operating costs in the following areas (circle one for each)?
   a.   Hours of operation / overtime ->   None   Slight   Moderate   Significant
   b.   Use of road salt and other deicers ->   None   Slight   Moderate   Significant
   c.   Vehicle fleet maintenance ->   None   Slight   Moderate   Significant

7.   What impact has use of the laptop had on your agencies response time to winter weather events? Check one:
____ No improvement ____ Slight improvement ___ Moderate improvement ____ Significant improvement

8.   Have you used the laptop for other purposes (check all that apply) ?
   a.   ____ Communicating via email with department employees
   b.   ____ Collecting field data
   c.   ____ Accessing or providing traveler information (CMS)
   d.   ____ Other work-related software. Please name: _____

9.   Is the laptop still sufficient to meet your needs? Check one: ___ Yes   ___ No
     Why or why not _____

10. Please provide any other comments you have on your experience with the use of the laptop computers (attach an additional page if needed):
     _____

     _____

     _____

APPENDIX B

Portable CMS – WisDOT Staff Sample User Survey Form

To WisDOT District Users of Portable Changeable Message Signs:

The Wisconsin Department of Transportation (WisDOT) benefited from Federal funding to purchase Portable Changeable Message Signs for WisDOT Districts 1, 5, and 6. The message signs were used by various officials along the Interstate 90 and Interstate 94 corridors to provide traveler information on traffic incidents, special events and advanced warning for construction projects. WisDOT is conducting an evaluation to determine how well this project performed at meeting the goals set by the Federal Highway Administration (FHWA) including improving the mobility, productivity and safety of travelers within the I-90/94 corridor.

Your help is needed to fulfill the obligations of the Federal funding and insure that WisDOT will be eligible for future Federal funding.   The following survey has been developed to obtain feedback from operators who have used the Portable Changeable Message Signs. We are requesting that you take the time to answer the survey questions, and include brief comments on your experience in the spaces provided.

In order for the required study to be completed according to a planned schedule, we request that the survey be completed within one week, and returned to your district coordinator.
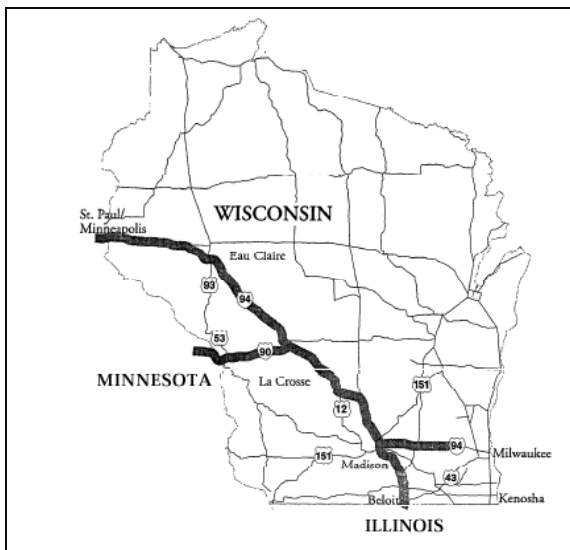
I-90/94 Earmark Evaluation
Portable Changeable Message Signs

SURVEY QUESTIONS - WisDOT Staff

1. What is your position at WisDOT?

   _____

2. How familiar would you say you are with the Portable Changeable Message Signs that are used on I90/94?

   Not at All Familiar   →   →   →   Very Familiar

   0   1   2   3   4

3. If you have used the Portable Changeable message signs, provide the location(s) by checking (or naming) the appropriate area(s):

   District 1___ : County: Rock___ Dane___ Sauk___ Columbia___ Other (name)_____
   District 6___ : County: Eau Claire___ Dunn___ St. Croix___ Other (name) _____
   District 5___ : County: Monroe___ La Crosse___ Jackson___ Other (name)_____
   District 4___ : County: Juneau___ Other (name)_____

4. Please describe how you work with or are impacted by the use of Portable Changeable Message Signs on I-90/94?

   _____

   _____

5. Please describe what you think about the Portable Changeable Message Signs that are used by your District on I-90/94 by circling the number that represents your feelings for each item:

Item	Worsened	→	No Change	→	Improved
a. Freeway safety	0	1	2	3	4
b. Incident response time	0	1	2	3	4
c. Incident clearance time	0	1	2	3	4
d. Travel Time	0	1	2	3	4
e. Information to motorists	0	1	2	3	4
f. WisDOT Operating Costs	0	1	2	3	4

6. How effective do you feel the Portable Changeable Message signs have been in improving conditions on I-90/94 (circle 0-4)?

   Not Effective   →   No Impact   →   Very Effective

   0   1   2   3   4

7. If you feel the Portable Changeable Message Signs are effective, please describe the improvements to conditions on I-90/94 that you have observed.

_____

_____

8. What do you think could be done to improve the performance of the Portable Changeable Message Signs?

_____

_____

9. How helpful do you feel the Portable Changeable Message Signs are to you in performing your job (circle 0-4)?

Not Helpful	→	No Change	→	Very Helpful
0	1	2	3	4

10. If you feel the Portable Changeable Message Signs are helpful to you in performing your job, please describe how.

_____

_____

11. What, if anything, could be done to make the Portable Changeable Message Signs more useful to you?

_____

_____

12. Please circle the number that represents your feelings for each item to describe what you think about the effectiveness of the Portable Changeable Message Signs that are used by your District on I-90/94 in managing the effects of :

Item	Not Effective	→	No Change	→	Very Effective
a. Crashes	0	1	2	3	4
b. Special Events	0	1	2	3	4
c. Weather Events	0	1	2	3	4
d. Planned Maintenance	0	1	2	3	4

13. How effective do you feel the Portable Changeable Message Signs are in enhancing the safety of maintenance staff in work zones on I-90/94 (circle 0-4)?

Not Effective	→	No Change	→	Very Effective
0	1	2	3	4

14. How helpful do you think <u>additional</u> Portable Changeable Message Signs would be on I-90/94 in your District? If they would be helpful, how do you think they could be best used?

_____

_____

15. Please describe any problems or difficulties that you may have experienced with the use or operation of the Portable Changeable Message Signs.

_____

_____

_____

16. How easy do you feel it is to coordinate the operations and use of the Portable Changeable Message Signs with the Wisconsin State Patrol or other law enforcement agencies (circle 0-4)?

Very Difficult	→	→	→	Very Easy
0	1	2	3	4

17. Please describe any problems you have experienced with coordinating the use or operation of the Portable Changeable Message Signs with the Wisconsin State Patrol or other law enforcement agencies.

_____

_____

_____

18. Have you experienced any difficulties with coordinating the operation of the Portable Changeable Message Signs with other staff or departments within WisDOT?   ___Yes ___No

19. If you answered yes to the previous question, please describe the difficulties you have encountered.

_____

_____

_____

20. Please describe any additional comments that you may have about Portable Changeable Message Signs (attach additional pages if needed).

_____

_____

_____

_____

_____

_____

I-90/94 Earmark Evaluation
Portable Changeable Message Sign

SURVEY QUESTIONS - Emergency Response Staff

1. What is your primary job title or function?
   a. *Lieutenant*
   b. *Sergeant*
   c. *State Patrol*
   d. *Other* _____

2. What agency do you work for?
   _____

3. How familiar would you say you are with the Portable Changeable Message Signs that are used on I90/94?

   Not at all familiar   ⟶ *Very familiar*
         0   *1*   *2*   *3*   *4*

4. Please describe how you work with or are impacted by the use of Portable Changeable Message Signs on I-90/94?

   _____

   _____

5. Please describe what you think about the Portable Changeable Message Signs that are used on I-90/94 in your area by circling the number that represents your feelings for each line:

a. *Freeway safety*	*Worsened*	*0*	*1*	*2*	*3*	*4*	*Improved*
b. *Incident response time*	*Worsened*	*0*	*1*	*2*	*3*	*4*	*Improved*
c. *Incident clearance time*	*Worsened*	*0*	*1*	*2*	*3*	*4*	*Improved*
d. *Travel Time*	*Worsened*	*0*	*1*	*2*	*3*	*4*	*Improved*

6. How effective do you feel the Portable Changeable Message signs have been in improving conditions on I-90/94?

   Not Effective   ⟶ *Very Effective*
         0   *1*   *2*   *3*   *4*

7. If you feel the Portable Changeable Message Signs are effective, please describe the improvements to conditions on the freeway that you have observed.

   _____

   _____

   _____

8. What do you think could be done to improve the performance of the Portable Changeable Message Signs?

    _____

    _____

    _____

9. How helpful do you feel the Portable Changeable Message Signs are to you in performing your job?

    Not Helpful ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯▶ *Very Helpful*
    0   *1*   *2*   *3*   *4*

10. If you feel the Portable Changeable Message Signs are helpful to you in performing your job, please describe how.

    _____

    _____

    _____

11. What do you think could be done to make the Portable Changeable Message Signs more useful to you?

    _____

    _____

12. How effective do you feel the Portable Changeable Message signs have been in increasing safety for emergency personnel responding to incidents on I90/94?

    Not Effective ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯▶ *Very Effective*
    0   *1*   *2*   *3*   *4*

13. How helpful do you think additional Portable Changeable Message Signs would be on your area of Interstate 90/94? If they would be helpful, how do you think they could be best used?

    _____

    _____

    _____

    _____

14. Please describe any problems or difficulties that you may have experienced with the use or operation of the Portable Changeable Message Signs.

    _____

    _____

    _____

15. How easy do you feel it is to coordinate the operations and use of the Portable Changeable Message Signs with the Wisconsin Department of Transportation and other law enforcement agencies?

Very Difficult ───────────────────────────────────▶*Very Easy*
　　　0　　　　　　　1　　　　　　　2　　　　　　　3　　　　　　　4

16. Please describe any problems you have experienced with coordinating the use or operation of the Portable Changeable Message Signs with the Wisconsin Department of Transportation or other law enforcement agencies.

　_____

　_____

　_____

　_____

　_____

17. Please describe any additional comments that you may have about Portable Changeable Message Signs.

　_____

　_____

　_____

　_____

APPENDIX C

I-90/94 Earmark Evaluation
Permanent Highway Advisory Radio for Hudson "Point-of-Entry"

SURVEY QUESTIONS

Wisconsin State Patrol

- Were there any initial operational problems with the Highway Advisory Radio system? If so, how long did they take to resolve, and what methods were used?

- How often do you need to broadcast messages on the Highway Advisory Radio? Please be as specific as possible, especially when the frequency is different by month, season, etc.

- What sources do you usually get your information from? (check all that apply)
    o State Patrol troopers
    o WisDOT staff
    o Local law enforcement
    o Drivers
    o Media
    o Other (please specify)

- Please describe the method used to activate the Highway Advisory Radio system and to enter a message for broadcast. Is the system easy to use?

- Are there any improvements or additional features that you would like to see added to the activation and data entry systems?

- What types of information do you normally broadcast over the Highway Advisory Radio system? (check all that apply)
    o Incident locations
    o Location / duration of severe congestion
    o Road closures
    o Detour routes
    o Weather conditions
    o Road / pavement conditions
    o Travel times
    o Other (please specify)

- In your view, due to the implementation of Highway Advisory Radio, to what extent has your agency seen improvements in the following categories:

o Reduction in vehicle delay ->	None	Slight	Moderate	Significant
o Reduction in primary accidents ->	None	Slight	Moderate	Significant
o Reduction in secondary accidents ->	None	Slight	Moderate	Significant
o Reduction in incident response time ->	None	Slight	Moderate	Significant
o Reduction in incident clearance time ->	None	Slight	Moderate	Significant
o Increased safety for emer. crews ->	None	Slight	Moderate	Significant
o Reduction in traveler inquiries ->		None	Slight	Moderate	Significant

- Are there any other potential uses for this system, or additional types of information that you would like to see broadcast?

- In your overall view, to what extent has the Highway Advisory Radio system been effective in improving the safety and efficiency of the targeted highway network?

- No improvement
- Slight improvement
- Moderate improvement
- Significant improvement

WSP, WisDOT and MnDOT Staff

The Hudson Highway Advisory Radio system includes one alert sign located near EB I-94 mile marker 253 in Minnesota, and the system can be used to broadcast important traveler information for the nearby portion of Minnesota.

- Were there any difficulties in coordination between the different agencies for this project?

- Are there any specific "success stories" that you would like to share regarding the coordination between the agencies?

I-90/94 Earmark Evaluation
Permanent Highway Advisory Radio for Hudson "Point-of-Entry"

Survey Questions - Web-based Public User Survey

- How were you directed to this web site?
    - o Broadcast message
    - o Sign
    - o Link from other website
    - o Other

The following two questions are for aggregate demographic purposes only:
- What is your gender?
    - o Male
    - o Female
- What is your age?

The Highway Advisory Radio alert signs are the blue colored signs that say "When flashing, tune to AM 530"
- Have you ever seen the Highway Advisory Radio alert signs flashing?
    - o Yes
    - o No
- Are the instructions on the alert signs legible and clear?
    - o Yes
    - o No
- Have you ever noticed an instance where the alert sign was flashing, yet there was no message being broadcast?
    - o Yes
    - o No
- How often do you listen to messages broadcast on the Highway Advisory Radio?
    - o Never
    - o Once
    - o A few times
    - o Every time I see the alert sign flashing
- Have the broadcast messages been clear and easy to understand?
    - o Yes
    - o No
- If you answered "No" above, why have the messages been hard to understand?
    - o Volume of voice is too low
    - o Too much static interference
    - o Speech is too fast
    - o Other

- In general, how helpful do you feel the messages have been?
    - o Not helpful at all
    - o Somewhat helpful
    - o Very helpful
- What types of information have the messages given? (check all that apply)
    - o Incident locations
    - o Location / duration of severe congestion
    - o Road closures
    - o Detour routes

- - Weather conditions
  - Road / pavement conditions
  - Travel times
  - Other
- In general, has the information provided been too specific, too general, or at an appropriate level of detail?
  - Too specific
  - Appropriate level of detail
  - Too general
- In general, how timely has the information been provided?
  - Timely enough for me to make a decision well in advance of the affected area
  - Just before I began to be affected by the conditions
  - Not timely
- If you answered "not timely" above, why was the information not timely?
  - I immediately tuned to the proper station, but reached the affected area before hearing the entire message
  - I didn't tune in to the station in time
  - The message did not have current information
- Overall, did the provided information help you to make any informed decisions regarding your travel route?
  - Yes, the information caused me to change my route
  - The information may have been helpful, but I did not change my route because of it
  - The information did not affect my choice of route
- In general, if you took an alternate route, were any of the following available to help guide you along the alternate route? (check all that apply)
  - Directions listed in broadcast message
  - Detour signs
  - Law enforcement agents
  - None … I had to rely on my own navigation
- In general, if you took an alternate route, why did you choose that route?
  - The radio message advised me to take that specific route
  - I knew the local area and chose to take the route myself
  - I was directed onto the route by law enforcement agents

- In general, if you took an alternate route by choice, do you think you saved travel time compared to if you stayed on the main route and traveled through the affected area?
  - No, I think the alternate route took longer
  - No, I think it would have been the same either way
  - Yes, I may have saved a minute or two
  - Yes, I think I saved a lot of travel time
- Do you have any additional comments or concerns about the highway advisory radio?

Web-based Public User Survey – Respondents Comments

- There have been times of serious congestion when HAR has not been available or updated with timely information. The lights were not flashing to give indication that there would be information at all.

- I drive thru Hudson 5 nights a week & have only seen the Highway Advisory Radio used 2 times. They don't come in very clear & when it does clear up you are right on top of what is going on. You need stronger radio output on both the WI & MN sides. The sign on the WI side is way to close & really doesn't give much of a warning.

- The highway advisory radios are good but the one by Hudson does not broadcast far enough. You can only pick it up when you pass Carmichael Road (traveling west) and by then it is too late. The traffic is backed up two miles beyond that point.

- Recently there was construction in Hudson. It was unclear on when lane closures would occur and how long the construction would last. It took me one and a half hours to go 5 miles one morning. There was a HAR message before construction started but all it gave was the location of the construction and a warning that traffic could be slow. On the day it took me an hour and a half all HAR said was lane closure, slow traffic. Specifically, I would have liked to hear when the lane closure would occur, ie 7:00pm-6:00am, and how many days it was going to take. There was a message this morning about road repair by Carmichael Road that I thought was complete.

- I hope the radio is used for alerts other than right around Hudson. I would hope it would also alert of problems towards the Cities or towards Menomonie.

- I came to this web site because I thought I would be able to get more information than what I heard (at low volume) on the radio. I couldn't understand when the E-94 at Carmichael one-lane of travel would be completed. The radio reception area is too small, and my husband's truck radio will not let us tune in to a station that is so weak. Thanks for the 'comments' section.

- The flashing lights and highway sign on HWY 94 just east of Hudson is in the wrong location. If there is a problem either along 94 in Hudson or on the bridge, during rush hour (morning mostly) the traffic backs up at least 7 miles to the Roberts Exit - If you don't have a sign there, there's no place to turn off the freeway for at least 5 miles at the Hwy 12 exit. So no, the placement of that sign is no good.

- Only that when the holdup is construction - as it is currently (Monday 8/25) - you don't specify when it starts/ends. Also, for those of us traveling further east, additional information (perhaps as far as Menomonie?) would be helpful in choosing an alternate route. As an example - construction between MM 10 and MM 16 is going to happen soon. If one misses the exit at MM 10, one is STUCK until MM 16...that is an example

of how it could be more helpful if congestion is present in the construction. Thanks! Great service overall!

- Coming from MN if you tune in your radio right when you see the sign, you will not get the signal until Carmichael road. Today 08-29-03 I did not get the message until I had already gotten to the road construction because of the weak signal

- I believe this service is under used. There have been major accidents in the Hudson to Baldwin area that have closed 94 or caused major, 2-5 mile back up of traffic. These have not had HAR messages.

- The most recent message was great - there was enough detail to understand what was going on. However, I wish the signal would work over a larger area. I took an alternate route this morning because they thought construction may last through this morning, but it didn't. If I could have heard the message this morning before I pull onto the highway, I would have gone my regular route. I think this is a great system. It is much safer to listen to the radio than to try to read the VMS signs posted on the road. Also, depending on traffic, you might not be able to see them well enough to read them. I would like to see them throughout my entire drive on 94, but I'd like to see it flashing before I get on the freeway so I could make a decision before it's too late to get back off.

- The Highway Advisory Radios are not as distracting as the signs. Traffic tends to slow because of the signs opposed to the flashing lights of the HAR sign. Unfortunately, not all cars have working radios, but then again, not all drivers can read! Please keep the HAR active!

- There have been times of serious congestion when HAR has not been available or updated with timely information. The lights were not flashing to give indication that there would be information at all.

- I am writing because I believe the radio alert poses a serious, potential traffic safety hazard. The sign west of Hudson on I94 is in a very congested area. Tuning to 530 AM is a distraction and risky maneuver. I felt obligated to tune the station and even then the radio signal was inaudible. I later faintly heard the message when I was driving on Wisconsin Street off the interstate about l mile in the City of Hudson. Your feedback and comments to me as a citizen would be greatly appreciated. Thank you.

- I like any information that is given in time for me to make a change in my commute. Any road conditions in the winter time I really need. I commute one hour each way to the twin cities each day.

- Location of blue information signs is sometimes hard to change travel route such as the back up on 94 West when Hudson had some evening repair problems. I heard information on K102 after I was already on 94 West and had no place to turn around to take another route (not even near the weigh stations were you able to exit and go East to travel another direction).

- Great tool! It is easy to listen and drive. The message is repeated frequently so if you miss it the first time, you can catch it in a few moments. Sometimes your views of the

VMS's are blocked by traffic or the sun. Hudson530 has too much static interference. I prefer VMS and HAR used together to provide necessary info to assist me in my travels.

- The radio was static-y but understandable, I was at Hwy. 95, not far from the Hudson broadcasting location, so I am not sure why the static. Actually, this is the first time that I noticed a flashing sign advising of turning to the station for traffic advice.

- Just the static. I tuned in on MN side but it took until I was at the top of the hill on Hudson side to clearly hear broadcast. Also, can signs be made to be also seen from opposite direction when they are activated (I enter the Interstate at Exit 4 heading east some days so I am already past MN sign and message if activated. Would be good to see on WI sign that a message is being broadcast.)

- At times the variable message signs I've seen come almost as I happen upon the incident OR happening so I'm in the thick of things and not able to make other choices.
- If the flashing sign has been on before, I haven't tuned in until tonight. I was very happy to hear it and if it would've had better reception I believe it's very good. I think it would have been in time to make another decision too. However, I didn't need to travel as far as this took them, so I can't say that for sure. Thanks for the efforts you are taking to make things safer for us.

- Radio is useful if the information to be conveyed won't fit on the message signs in two or three screens, but signs are often more convenient since I don't have to play with my radio dial. Anything that involves more than a dozen words would be better communicated via radio.

- Originally, I wasn't sure how these were going to work and wondered if I would even notice the flashing lights. Well, they work great and I notice the lights almost every time they are on. The messages have saved me a ton of time since I have alternate routes I can take and have chosen several times when accidents or construction have constricted or closed the freeway. Thanks and keep up the great work.

- Signal is too weak to be effective.

- Information on radio is too general and not updated for construction and accidents. Especially during rush hours, real-time updates would be helpful.

- I tune in even when not flashing. The more info, the better. Last year during construction at Hudson I detoured to Prescott to get to Twin Cities and I still think I saved time.

- I like the radio better than the signs because you don't have to take your eyes off the road. Thanks for reading.

- Note that I have only seen the sign flashing once. When I tuned in when it was flashing, all I heard was the message about this website repeating. Very static and distant sounding message. Only heard broadcast for about 30 seconds while going thru Hudson on I94. Overall, the highway advisory radio is definitely a great tool for major roads, and I do hope that more of them will be in place in Wisconsin and the surrounding states. As

a local truck driver, even using a certain CB channel for broadcasting would be a good tool.

- Suggest you add additional sign at exit 4 (TA station area) for radio alert as people come on the freeway.

- The station barely comes in. The static is so bad that I am usually on the bridge before I can make out all of what is being said. Since the bridge is usually the dangerous area (wind, ice) the radio advisory doesn't help.

- The one time that I tuned to the radio broadcast I found it difficult to understand due to the static and when I did finally figure out what it was saying it was only telling me to login to the website. There was no traffic message.

- Yes. We just drove by a flashing highway advisory radio blue sign. Tuned immediately to 530 AM and all we got was station identification and an advisory to go to this website. Really! How can you check a website when you are driving????? Not very helpful, to say the least and could prove dangerous. The appropriate warning message or advisory message should be repeated over and over until the incident is over - and THEN THE FLASHERS SHOULD BE TURNED OFF!!!!

- There were extreme weather conditions during the past 24 hours. The sign was blinking, however only gave broadcast band and reference to this survey. It is not good to try to tune in to the radio in bad weather and then have no benefit for the effort. Where was the information I needed?

- Last night (Tues, Dec 9) was very bad weather. I saw the flashing light before the MN/WI bridge and tuned in to see what was happening. All I heard was the "Thank you for listening ..." and "Please take our survey ..." Nothing about the weather, roads, or anything else was available when I REALLY needed it. The flashing sign on I-94 in MN needs to be moved back somewhere between CR 13 and CR 15. Where it is now does not give ample opportunity to avoid any mishaps in Hudson, which is where that sign should focus (ie: Hudson, River Falls, nearby cities, not cities that take 45 minutes to drive to), by taking exits to visit family, friends, or shopping centers. Also, one of those flashing signs needs to be set up between Exit 4 and Eau Claire. Then if we are traveling past Hudson, we can hear about stuff that affects the commute. I don't need to hear about Eau Claire problems when I work in MN and live in Hudson and only travel to Eau Claire once in a blue moon. Thanks for letting me share. Have a great day!

- The pace of the message is to slow and general & too hard to hear, need more power!

- There have been several times that I have seen the yellow flashing lights but there was no message concerning traffic conditions. The message didn't even mention this website. The lights should only flash when there is a message about the road/traffic conditions.

- I think the broadcast system is not helpful enough and should be tuned over to a local youth group or organization (Hudson Middle School students).

- I think the station broadcast is not helpful enough and should be turned over to a group of willing and responsible Hudson youth.

- I commute M-F from Hudson to St. Paul, Minn. The H.A.R-A.M. signal in Minnesota is very weak at the point where there is a sign and blinking lights, just before the Wisconsin line. My radio tuner's signal sweep passed over the signal and I have to manually tune the radio -- even then static interferes and the voice is weak. The commercial stations in the Twin Cities fail to cover conditions on I-94 from Exits 3-4 in Wis. into the intersection I-494/I-694. MN DOT and WI DOT need to provide road condition reports on this small stretch of highway.

- In recent weeks the eastbound lights are sometimes flashing and no message on radio. The messages would be more helpful to me if they included mile marker locations instead of just highway designations - I don't know which exit is Hwy 12 for instance.

- The radio signal is not strong enough to be heard from mile markers 3 to 9+.   My experiences have also been that this is much worse at night. Also, one of the times the broadcast came on the information was completely inaccurate.